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AMERICAN ANTIQUITY

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PRACTICAL AERIAL PHOTOGRAPHY FOR ARCHAEOLOGISTS

RALPH S. SOLECKI

THE advantages of aerial photography to the archaeologist have been expertly described in the literature, especially by O. G. S. Crawford (1928, 1954), the English pioneer in this field. *Wessex from the Air*, by Crawford and Keiller (1928), is still a classic study in aerial archaeological photography. An aerial view of an archaeological site, especially before excavation, will furnish invaluable leads to the appraisal of the site. A good aerial photograph tells the story at a glance. With its added intelligence the archaeologist can better apportion his work. The purpose of this paper is to show the interested archaeologist how to get good aerial photographs himself at little cost. Concerning other aspects of aerial photography, the bibliography by Rowe (1953) may be consulted.* The various issues of the journal *Antiquity*, of which Crawford is editor, contain a wealth of material on aerial views as a direct result of his interest in the subject; a cumulative index of the first 25 volumes makes this information easily accessible.

It must be emphasized that details which are plainly evident on the original glossy print are all too readily lost in the publication of aerial photographs. Hence it should be remembered that the copy seen in a publication is never as good as the original.

For the archaeologist who cannot afford the expense of obtaining a professional aerial photographer (who may want $50.00 or more for the job), the prospects of obtaining aerial views of his site may be discouraging. The simplest alternative is to go with his own photographic equipment to the nearest airport on a clear day and hire the services of a pilot with a light airplane. With little or no prearrangement, the archaeologist who goes aloft in the rented plane may come back with a few good pictures. On the other hand, he may not have any luck at all, and wonder why. But with a little care and preparation good views of archaeological sites may be obtained even using limited materials and equipment.

For a briefing on the main problems of light plane photography the most readily available and inexpensive texts are 2 Eastman Kodak Company publications which can be had at almost any camera shop. These are *Pictures from the Air with Your Camera* (1952, $0.35) and *Materials for Aerial Photography* (1950, $0.50). The former publication is especially useful. A Navy publication (Anonymous 1947), *Photography*, in 2 volumes, dealing in part (Vol. 2) with aerial photography is a valuable aid selling for $3.50 by the Superintendent of Documents.

There are 3 different kinds of aerial views: high oblique, low oblique, and vertical. *High oblique* photographs (see Fig. 1) include some part of the horizon in the frame (Crawford 1953, Pl. 1; Eastman Kodak Company 1952: 3, *top*; Hart 1943, Fig. 141; Anonymous 1947, Vol. 2, Fig. 24; Wedel 1953, Pl. 7 *a*). Most people are familiar with the high oblique view as from a hill (Crawford 1953, Pl. 24). *Low obliques* are at an angle between high obliques and verticals (Crawford 1953, Frontis., Pl. 15; Eastman Kodak Company 1952: 3, *bottom*, 6, 7-8, 15; Anonymous 1947, Vol. 2, Fig. 25; Reeves 1936, Pl. 5; Riley 1946, Pls. 1 *b*, 2, 3 *a*, 4, 5 *a*, 7; Roberts 1954, Pls. 4, 5; Wedel 1953, Pls. 1, 2, 3 *A*, 4, 5 *B*). Obliques sometimes appear upside down in publications (Anonymous 1940, Fig. 5) because absence of the horizon makes interpretation more difficult. A *vertical* view is one with the optical axis of the camera vertical or nearly vertical to the ground surface (Bradford 1952, Figs. 1-4; Crawford 1953, Pl. 19; Hart 1943, Figs. 4, 13, 34; Anonymous 1940, Figs. 2, 4, 6; Anonymous 1947, Vol. 2, Figs. 5, 26; Reeves 1936, Pl. 3, *Fig.* 2; Riley 1946, Pls. 1 *A*, 5 *B*, 6 *A*). Verticals are useful for mapping and plotting. They should be taken to supplement obliques, but give little impression of relief unless viewed

* EDITOR'S NOTE: A future issue of AMERICAN ANTIQUITY will contain an article by William C. Miller on the use and interpretation of aerial photographs, especially for purposes of mapping.

FIG. 1. A Piper PA 11 tandem seating airplane, seen in an oblique view. Good forward obliques are obtainable from it with the photographer in the front seat. Verticals are difficult to obtain because of the landing wheel. The struts on the wing block pylon views. The side window is easily folded down for photography. (Photograph courtesy Eastman Kodak Company.)

stereoscopically. For nontechnical purposes the oblique view is better, since details of relief are easier to recognize and identify. True, there are varying elements of distortion in oblique views, but the advantages outweigh this fault. Of the 3 types, the vertical is the hardest to "stop" or record without blurring. Vertical photographs taken in sequence, or "strip photography," require special modifications of the aircraft, such as insertion of the camera in the belly of the plane, as well as special knowledge and equipment (Hart 1943, Fig. 40; Anonymous 1947, Vol. 2, Fig. 27; Schwalberg 1952, Fig. 7). Some archaeologists, E. F. Schmidt (1940) in Iran for instance, have strip-photographed sites using special equipment and apparatus. However, for the average archaeologist, photographing small single objectives, this is not feasible.

A general rule to follow is that photographs should be taken in the most brilliant sunlight, or failing that, with a very high thin cloud layer. The best light is between 10 A.M. and 2 P.M. Special shadow effects desired in archaeological photography may dictate the taking of pictures in the earlier morning or later afternoon sun. Photography in the hot desert, of course, has its special difficulties of too much glare and of sand haze (Anonymous 1940: 38, 40; Poidebard 1934: 11-12).

Choosing a camera for the work depends upon the equipment the archaeologist has at hand. Any ordinary hand-held camera used on the ground may be used in the air — portability, ease of manipulation, and adaptation to the aircraft being some of the main prerequisites. But let there be no mistake. There is nothing better for the purpose than an aerial camera, if available. There are several hand-held types such as the K-10 and K-20 sold reasonably cheaply as war surplus. It may be advisable to add weights to lighter cameras for steadiness. Roll film and film pack cameras can be used equally well. A box camera can be used, but of course it is not ideal, and ideal results should not be expected from it. A camera loaded with color film, such as Kodachrome, should be taken along as well as black and white film. Since reloading the ordinary type of camera in the air is not especially difficult, extra film can be taken along for each camera. One camera loading for a site should more than suffice. The camera setting for distance should be firmly fixed or taped at infinity. Given a choice of lenses, the longer focus lens should be used, since it will make the objective fill a larger area on the film. In addition, the longer focus lens will not make it necessary to fly at a low elevation above a small objective in order to get a good-sized image in the finder. Of course, the view can be enlarged in the darkroom, but it is far better to start with a larger shot in the first place. There is a simple formula for determining what area of coverage you will get with your lens equipment at any given altitude on vertical views (oblique views require more complicated formulas):

$$\text{Scale} = \frac{\text{Focal length of lens in inches}}{12 \times \text{Altitude in feet}}.$$

The altitude is multiplied by 12 to convert to inches. Thus, if one has a 4-inch lens on a camera, and expects to take vertical photographs at 1000 feet, the scale will be 1/3000. In other words, 1 inch on the negative will equal 3000 inches or 250 feet on the ground. From an altitude of 500 feet, 1 inch on the negative will equal 1500 inches on the ground, or 125 feet, which would be more satisfactory for most small archaeological sites. However, at low altitudes, the speed of the aircraft introduces a factor which must be compensated for. The shutter speed must be increased consider-

ably, with consequent enlargement of the lens aperture.

To cover complex sites taking in a large area, the photographer will find that an altitude of 2000 feet and more may be necessary to get the whole site framed. J. S. P. Bradford (1952: 179) says that a scale of 1/6000 is best on vertical shots. Stereoscope magnification on strip photographs, not taken up here, will bring out details 2 or 3 times enlarged.

Other things being equal, if there is a choice between a camera with a larger film size and a camera with a smaller film size, the larger will be more satisfactory. The type of camera used by the press photographer is adaptable to aerial work. One commercial photographer says that a 4 by 5 Graflex with an F 3.5 Carl Zeiss lens will outperform at low altitudes the best of aerial cameras in general use (Burrows 1952: 42). A camera with a film winding mechanism which simultaneously advances the film and cocks the shutter eliminates the possibility of double exposure and allows faster camera operation. The view finder should be at eye level for optimum framing of the objective. The sports type finder is best.

Under normal conditions, a filter will not be necessary if the altitude is less than 1500 feet. A filter is advisable if the angle of view includes any part of the horizon, as in high obliques. The filter reduces the veiling effect of atmospheric haze. Filters must be compensated for in the exposure time or stop opening, hence the need for filters must be weighed against the job in hand. For high oblique or high altitude photographs, a red or yellow filter is generally used. For color film, it is a good idea to use the colorless haze filter, which does not require any change of exposure time or stop openings. Use of supersensitive panchromatic film, such as Super XX or the newer Tri-X, is recommended in order to make the most of the camera speeds, especially when filters are used.

The sun shade is a very necessary part of the kit. Like any other accessory, it should be firmly fixed on the lens. Exposures should not be taken directly toward the sun if it can be helped. A "flat" negative will result. Poor negatives may result also if oblique photographs are taken with the sun directly behind the camera. A 45° angle between the sun and the line of sight will light the objective to best advantage. Knowing the archaeological site beforehand, some idea of the angle of view wanted will influence the time of day selected for the photography. This is especially true when selecting views with shadow detail. Shadow may be necessary to bring out relief and to outline certain exposed features such as pits and postholes. Too much shadow may obscure the very things wanted. At the discretion of the archaeologist, one archaeological site may demand one viewpoint, another a different viewpoint. Streams, hills, other sites in the vicinity, and similar features of topographical significance will affect the desirability of one view over another. The selection of the viewpoint is the prime reason why the archaeologist should accompany the flight, even if he does not take the pictures.

The most critical things about taking an aerial photograph are (1) the shutter speed, (2) the size of the opening used, (3) the ground speed, and (4) the altitude of the airplane. The shutter speed required to stop the apparent motion of the ground depends in the main on the latter two. The chances for getting an oblique photograph at lower altitudes are better than for vertical shots at the same altitude in light plane photography. The photographer must remember that in oblique angle photography, he must use camera settings which will give clarity of detail for the nearest objects in the viewfinder. Objects farther away in the oblique view will take care of themselves in the same exposure. The principle behind this rule is that the image of a near object on the ground will travel a longer distance across the negative or focal plane than the image of an object farther away in the same unit of time. In other words, a vertical or near vertical photograph is more prone to blurring of the entire negative than an oblique.

Another good rule to remember is that the higher you go or the shorter your camera lens's focal length, the slower do images of objects on the ground move across the focal plane. But on the other hand, the objective will become smaller, a drawback. Conversely, the lower you are, and/or the longer the focal length of the lens, the faster the rate of image travel on the focal plane, and the more chances of blurring. The first consideration is to produce a photograph which will show the site with distinctness and clarity of detail in workable proportions. Since some compromise must be made on the 35 mm. camera, it is advised to use the 90 mm. lens for close-ups on sites, and

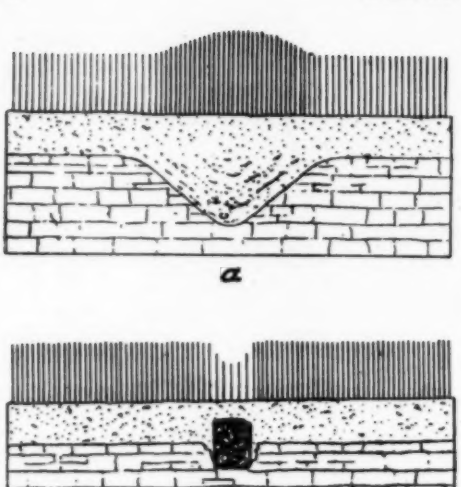

FIG. 2. *a*, section view through a positive crop mark. Vegetation growth has been enriched by the ditch filling. *b*, section view through a negative crop mark, a rare feature. Vegetation growth has been reduced by a subsurface feature, such as a buried wall foundation. (Reproduced by courtesy of D. N. Riley, and *The Archaeological Journal*.)

the 50 mm. lens for wider views at altitudes between 500 and 1000 feet. For Kodachromes, satisfactory obliques in slowed-down aircraft using an exposure of F 5.6 at 1/100 of a second or F 3.5 at 1/300 of a second were made by the River Basin Surveys of the Bureau of American Ethnology, Smithsonian Institution, in the Missouri Basin in 1952 (Solecki 1952a). The Graflex 4 by 5 camera with the standard lens is a good camera for black and white photographs. Using fast panchromatic film one photographer advises a basic exposure of F 6.3 at 1/800 at an altitude above 500 feet (Burrows 1952: 42). Another professional photographer, Frank Fulkersin of Flint, Michigan, also prefers a fast speed, using F 8 and F 11 at 1/500 of a second with fast film at low altitudes. In the helicopter Fulkersin prefers to photograph with speeds at least 1/200 of a second. The majority of the photographs taken by the River Basin Surveys aerial reconnaissance were exposures using F 11 at 1/200, showing that there is quite a bit of leeway possible. With black and white film, there is considerable additional latitude in the darkroom processing, which can correct for a fair amount of under and over exposure. With color, the amount of latitude permissible in the exposure is restricted. It is strongly advised that the tables at the end of the publication *Pictures from the Air with Your Camera* be studied for particular lighting conditions, altitudes, speeds, and so on, for color, black and white, and 8 mm. and 16 mm. motion picture film.

The first consideration, as noted above, is the shutter speed, the setting upon which the lens opening depends. Recommended shutter speeds (adapted in part from *Pictures from the Air with Your Camera* by permission of the Eastman Kodak Company) are given in Table 1.

TABLE 1. SLOWEST RECOMMENDED SHUTTER SPEEDS FOR AMATEUR AERIAL PHOTOGRAPHY FOR VERTICALS OR LOW OBLIQUES

Altitude in Feet	*Ground Speed in Miles per Hour*			
	75	*100*	*150*	*200*
4000 and up	——	1/50	1/50	1/100
3000	——	1/50	1/100	1/100
2000	——	1/100	1/100	1/200
1000	——	1/200	1/250	1/400
500	1/250	1/400	1/400	1/500

Slower shutter speeds may be used as the airplane approaches or leaves the site.

I have found that exposure meters can be helpful in low altitude work if used with care. If used from the airplane, reflection from wing surfaces or other parts of the airplane should be avoided. Haze, generally associated with altitudes, will affect the exposure meter re-

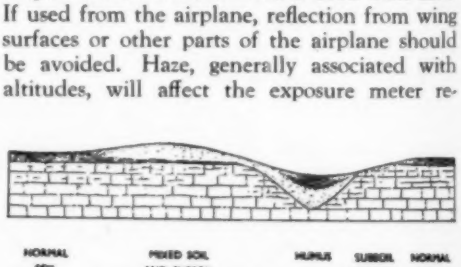

FIG. 3. Section and top views illustrating the formation of a soil mark resulting from the excavation of a ditch. The normal soil has been cut into and disturbed. Humus has collected in the ditch as subsequent fill. (Reproduced by courtesy of D. N. Riley, and *The Archaeological Journal*.)

sponse and give a false reading. For short flights, I have discovered that an exposure meter reading taken on the ground before going up will yield good results. This assumes that the terrain to be photographed has the same light conditions as the terrain where the exposure meter is read.

The cameraman must know his equipment perfectly. His motor habits should be well rehearsed. Like the novice on his first hunt, the photographer can get "buck fever" and compound errors unknowingly on a flight.

Professionals have found that in the problem of obtaining sharp pictures, the movement of the camera during exposure due to unsteady handling, rough air, or vibrations carried through the airplane frame gives more trouble than the speed of the airplane. The camera should be held against the chin, away from all structural parts of the airplane during exposure. No part of the photographer's body from the waist up should be braced on any part of the structure. The pilot can help in reducing engine vibration by reducing throttle momentarily during the actual picture taking. This also eliminates the propeller slip stream which causes gusty vortices. Exposures longer than 1/100 of a second should be avoided. On the matter of stable "platforms," the air will be generally calmer in the early morning and late afternoon. The bumpy air from the heat waves of midday will not be present, although midday is the best-lit time of the day for photography.

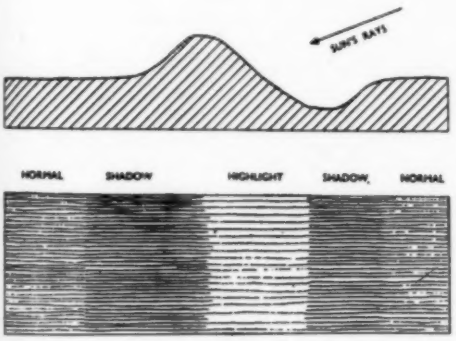

FIG. 4. Section and top views of a shadow mark made by a ditch and earth bank. The highlight is produced by the angle of the earth bank to the sun. (Reproduced by courtesy of D. N. Riley, and *The Archaeological Journal*.)

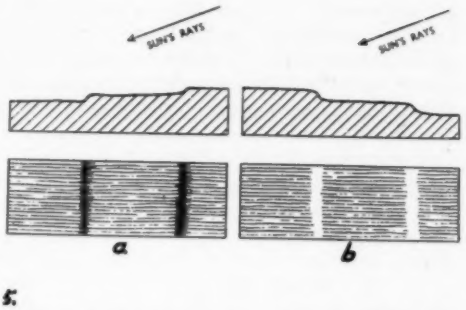

FIG. 5. Section and top views of slopes called "lynchets," lying between plowed fields, illustrating (*a*) demarcations brought up by shadows of features, and (*b*) demarcations brought up by highlights of features. (Reproduced by courtesy of D. N. Riley, and *The Archaeological Journal*.)

Archaeological sites have certain characteristics which make them different from the commonplace subject for aerial photography. To bring out these characteristics may require special handling of the problem. From an elevation, an archaeological site will reveal surface features which cannot be seen or appreciated from the ground. The archaeologist is interested primarily in man-made alterations of the original ground surface. These alterations may be detected from the air and classified into 3 main categories. These are "crop marks," "soil marks," and "shadow marks." In addition there are the rarer features called "damp marks," "frost marks," and "snow marks" (Riley 1946: 4-5, 14).

By crop marks is meant the visual difference in the growth of vegetation (grass, weeds, planted crops, and so on) on a site as contrasted with its normal surroundings (Atkinson 1953, Pl. 2; Bradford 1949, Pls. 2-6; 1952, Figs. 1, 2; 1956; Crawford 1929, Pls. 1, 2; Poidebard 1934, Pl. 4; Riley 1946, Pls. 2-7; St. Joseph 1951, Pl. 14). These contrasts are induced by differences in the soil constituents or "surface geology" on a site. The lush greenness of the unexcavated Plains earthlodge or fortification ditch in contrast to its dun colored environment is an example (Solecki 1952a: 47). Ideally, if the budget allows, the archaeologist-photographer should go aloft several times to catch the site at different times of the day and seasons, as the late Major George Allen in England did (Crawford 1952: 46-7; St. Joseph 1951: 310-1). It must be cautioned that a ground check is

advisable before any conclusions are reached. Earth-lodge depressions in the western Plains made by horticultural Indians look just like the numerous buffalo wallows; there is a collection of earth-lodge sites within a fortification ditch near Pierre, South Dakota, which the early settlers misnamed "Buffalo Pasture."

Naturally, there are times of the year when the vegetative differences are most pronounced. Thus, crop marks are restricted to the growing seasons of the year, in the northern latitudes between April and August. For fully flourishing growth and generally the best photography, the best months are in the middle of the summer. Some exceptions can be made to this rule. The relatively better watered depression features on the Plains are best observed in the fall when the surrounding grass is wilting. On the other hand, an organic-debris enriched site shows up best in the spring, with its quickened growth of cover.

Riley (1946: 14, Pl. 3) notes that there are 2 kinds of crop marks. These are positive and negative crop marks (Fig. 2). Positive crop marks are vegetation traces whose growth and lushness indicates a soil nourishment higher than its normal surrounding environment. Negative crop marks, a rare occurrence, are shown by an abnormally stunted or even killed vegetation. This indicates that something in the surface geology, such as a layer of stones, is inhibiting the growth of vegetation.

The time of day does not make much difference to the photography of normal crop marks. But a still day should be chosen for best results since these marks are most sensitive to winds. On obliques in a low sun, the color differences in green cereals, such as wheat for instance, show up better when looking with the sun than against it. The sun lights up the stalks and leaves, bringing out any color differences in the field. Looking at the same objective against the sun throws the stalks and leaves of the green vegetation into many small confusing shadows facing toward the photographer. This viewpoint on obliques also holds true for soil marks in plowed fields.

Soil marks (Fig. 3), the second major category, are indications on bare earth of contrasts between soil and subsoil, or between ditch fillings and normal soil (Bradford 1947, Pls. 2, 2 *B*; 1956; Crawford 1934, Pls. 12, 13; Poidebard 1934, Pl. C; Reeves 1936, Pls. 3, *Fig. 1*, 4, *Fig. 1*). Included in the category of soil marks are cleared areas of ground, generally in the desert, as in Peru (Kosok and Reiche 1947; Reiche 1949); the American Southwest (Setzler 1952: 392-5, 397, 398, *bottom*); and in the Near Eastern deserts (MacDonald 1934, Pls. 3, 8; Poidebard 1934, Pls. 2, *Fig. 1*, 14; Rees 1929, Pls. 2-9). In these indications, stones have been removed from the areas delineated and piled on the borders, leaving a cleared patch which is readily visible.

Soil marks are also found when the debris of destroyed buildings is encountered. Any upturned soil may reveal a contrast in earth coloration. Familiar are the soil marks made by the archaeologists themselves, with excavations, trenches, and pits, whose scars are like beacons from the air (Lehmer 1954, Pl. 1 *A*, *B*; Wedel 1953, Pls. 1, 4 *A*). Many prehistoric earthworks have been brought to light by soil marks, even in plowed fields where there is no indication of surface relief. The film emulsion may be responsive to one kind of soil coloration and not another. This would require tests which are beyond the scope of this paper. The beginner in archaeology in the eastern United States learns early to associate a scattering of shellfish fragments and a concentrated area of dark stained earth with an archaeological site (Solecki 1954, Pl. 1). The normal action of weather on soil marks is not so destructive as is agriculture. In general, it can be said that soil marks can be studied only in winter and in spring on areas at least temporarily barren of ground cover, such as cultivated fields. The time of day for photographing soil marks is not of much importance, nor is the camera position with relation to the sun an important factor in general.

The intaglio-like image made by a prominent earthwork is a familiar example of a shadow mark or cast (Figs. 4, 5 herein; Atkinson 1953, Pl. 1; Crawford 1953, Pl. 8; Curwen 1927, Pl. 3; 1930, Pls. 4-7; St. Joseph 1951, Pls. 15, 16). It is the result of a shadow cast by a low sun on a feature with some kind of architectural relief. This includes elevation and depression relief, as in a bank or ditch. The general rule is that the shallower the relief, the lower the sun must be in order to bring it up. A real difficulty is that the site may be ringed by hills, woods, or buildings casting their own shadows and obscuring details (Judd 1948: 112-3). As pointed out by Riley (1946: 12-13), some earthworks, which are perfectly obvious in a low

sun, will not show at midday. The sun should be between 45° and 90° to the line of sight (as in a vertical or near vertical view). The direction of the sun should be considered when taking obliques, in addition to its position. Thus, generally in taking shadow casts of low relief in oblique views, the shadows should be facing the photographer. Therefore, the site must be positioned between the sun and the photographer, or nearly so, care being taken to guard against "flare." It is imperative that the lens be well shielded. The positioning of the objective between the aircraft and the sun is called "countre-jour," or "counter-lighting" by one authority (Poidebard 1934: 11-12, Pls. 19, 91). The counter-lighting effect was achieved with a low altitude and a low angle of sun and a wide angle lens. Poidebard (1934: 11, Pl. 7, Fig. 1) also took successful photographs under a heavy cloud canopy.

Highlights on the slopes of earthbanks are best brought out when the slopes are facing the camera in oblique views. Therefore, for highlights the sun must be positioned to the rear of the camera, and the site is viewed with the sun. The spotlight quality of the sun plays a lesser role in soil or crop marks, since they are invisible more because of color than relief. Shadow sites can be photographer all the year round when weather permits flying.

While some of the above advice may seem to go against the rules of good photography, it must be remembered that archaeological photography has its own peculiar problems which require special handling.

Forearmed with this technical knowledge, the archaeologist-photographer will be ready to seek his "platform." Kites and balloons have been used successfully as platforms for aerial photography (Crawford 1954: 206), but these

FIG. 6. Photographing from a Bell Helicopter. The camera in the picture is a Fairchild K-20 aerial camera, using 4 by 5 roll film. (Photograph courtesy Frank Fulkersin.)

are quite special adaptations and the airplane is better suited for our purpose. Double extension ladders and outsize tripods also have been used for lower elevation pictures. The helicopter (Fig. 6), of course, is the best and most versatile platform we have at present (Crawford: 210; Setzler 1952: 391, *bottom*, 398 *top*). Helicopters, however, are not as easily obtained as ordinary light planes. For the expedition of limited resources, the price of about $70 an hour for the rental of the helicopter militates against it. It is not likely that the support of the U.S. Air Force, such as Setzler (1952) received, will be available to ordinary missions.

The alternative advised here is the light airplane, in about the 75 horsepower class, with cruising speeds up to about 100 miles an hour. A light airplane such as a Piper or Aeronca can be rented for about $12 to $14 an hour from a local airport. This is the student flying instruction rate, which might be obtained if the idea of the mission is explained. The prospective cameraman will find airport managers generally sympathetic to purposes of a serious nature. The pilot will usually be the flying instructor of the field. He may have been pilot on other photographic missions, and consequently may be able to offer helpful suggestions. The photographer may find a pilot with a plane who will volunteer to take him up in payment for the gasoline. This may be perfectly satisfactory, and a cheaper solution. In any case, the photographer should feel a perfect confidence in the flying ability of the pilot, because it will have a bearing on the quality of his photographic work.

The photographer will find his selection of planes on the line limited to 2 major types—the low wing monoplane, such as the Ercoupe (Fig. 7), and the high wing monoplane, such

Fig. 7. Nathaniel L. Dewell and Ralph Solecki getting ready for a photograph mission in an Ercoupe. The camera is a Folmer Graphic Aero Camera K-10, using 5 by 7 roll film. (Photograph courtesy Smithsonian Institution.)

as the Aeronca, Cessna, and Piper (Figs. 8, 9). High wing monoplanes are more common than low wing light airplanes. The biplane, such as the Stearman, an open cockpit tandem seating type, is not recommended because forward visibility for camera work is restricted and communication with the pilot may be difficult. However, excellent work has been done with the biplane (Poidebard 1934). Although the tandem seating type monoplanes such as the Piper Cub and Aeronca Champion are good, the photographer may do better if he selects a side-by-side seating aircraft. It will be easier to communicate with the pilot in the latter arrangement, since above all, the pilot and photographer must form a team.

More often than not, the selection will be limited by the aircraft available at the airport and by the pilot's choice. But if these include the Ercoupe, the Globe Swift, one of the Piper models such as the PA 11, the Aeronca Champion or Chief, or one of the lighter Cessna models, the photographer should have success in his hands. Slow aircraft speed is essential for the work. The photographer must beware of the airplane with side protruding engine exhaust stacks, such as the Piper Cub J-3 (Fig. 8), since exhaust gases will produce heat wave distortions in the photography. However, most light planes are now equipped with under-engine exhaust stacks, eliminating this worry.

Some types of the Piper airplane (Fig. 1) are readily adaptable for aerial photography since they have a convenient window panel which folds down on the right side. On most other light high wing airplanes, the right door must be removed for photography (as in the Cessna and Aeronca), a simple job needing only a screwdriver. Photography to the side is restricted in the lighter high wing airplanes by the wing struts. The wheel generally restricts downward or vertical photography. However, both good rearward and forward obliques are easy to obtain from these airplanes. The Piper Tri-Pacer appears to be a common airplane at most airports (Fig. 8). But if any of the other airplanes are available, the Tri-Pacer should not be selected, since it is a structurally difficult ship to shoot from (without modification). The Cessna 170 (Fig. 9), also a popular type, has ample viewpoints for photography, although forward oblique shooting is poor. For forward obliques in all light high wing monoplanes it must be remembered that, in addition to the

FIG. 8. Line up at the airport. The first airplane is a Piper Tri-Pacer, a 4-passenger, side-by-side seating airplane. Forward obliques are the only relatively easy photographs to obtain from the unmodified airplane. The Cessna 140, next on line, is easier to shoot from. It has side-by-side seating. The third airplane is a Piper J-3, a popular tandem seating plane with good forward oblique visibility from the front seat. The window and side fold downward.

wing strut, the photographer has to allow for the whirring arc of the propeller which cuts into the view. It is possible that the structure, visibility, and seating arrangements of the airplane may be such that he may obtain obliques only by shooting to the rear of the airplane.

The low wing Ercoupe is fairly common, and if available, should be selected. Preparation for photography from this airplane is simple, and good obliques may be obtained to the front and rear, in addition to the side (Roberts 1954, Pls. 4, 5; Solecki 1952a: 1, 42, 47; 1952b, Fig. 3). With the right wing dipped, a full panorama may be had over a 180° field of view. Verticals may be shot from the low wing plane, but it is necessary to stand the ship up nearly on wing tip momentarily, a precision maneuver not recommended at low altitudes. The Erçoupe has a spin-proof feature which makes it exceptionally safe. The Globe Swift, another somewhat faster low wing monoplane which also seats side by side, has approximately the same viewpoints as the Ercoupe.

The seating arrangement should be carefully checked on the ground for camera angles. All photographs will be taken from a sitting position. An additional seat cushion to give the photographer another 2 or 3 inches sitting height will give him a better view in the low wing plane. For more freedom of movement in the photographer's compartment, it is a good idea to remove the auxiliary "stick" or control wheel, if one is present. Camera equipment naturally must not be stored where it may interfere with or possibly jam the control mechanism. An open cardboard box, such as an ordinary shoe box, between the feet is a handy storage place. The seat belt, which must be fastened at all times, may be loosened to permit action. A shoulder harness is apt to be too restrictive.

It is assumed that the camera shots will be made in the open air, either through an open

FIG. 9. The Cessna 170, a 4-passenger side-by-side seating airplane. Forward and rearward obliques, as well as vertical views can be obtained relatively easily from this airplane. The extreme forward position of the single wing strut permits a good view in a pylon turn.

window, or open door. Glass or plastic windows often have disturbing reflective qualities, and make photography difficult if not impossible. The door on most light aircraft is on the right side, through which the photographer will be shooting. On some low wing monoplanes, the canopy is pushed down or pushed back according to the type of aircraft.

The photographer is cautioned not to wear flapping clothes or a loose brimmed hat. An inadvertent leaning out of the cockpit might result in clothing caught in the slipstream with annoying effects. Glasses and all other removable apparatus should be tied down or firmly fixed. The camera should be secured by a neckstrap. If a bellows camera is used, a shield should be made to protect the bellows. Otherwise it will be whipped away in the hurricane blast over the side of the ship.

When making the inspection of the seating arrangement in the airplane, it must be remembered that it is a shifty platform once airborne. The airplane tilts, tips, and crabs in its ordinary flight, in addition to diving, as controlled by the pilot. Tipping is the rising and falling of the nose of the airplane. Tilting is the dipping of the wings on either side. Crabbing is the aeronautical term used for correction in direction allowing for wind drift. Each of these, severally or in combination, will affect the photography angle. Thus the airplane sitting on the ground is not in exactly the attitude of the platform the photographer will use in the air. In fact, an aircraft with a tail wheel will be sitting in a nose high position, an angle from which the photographer will definitely not be shooting. An aircraft may seem to be perfectly suitable on the ground, but once in the air in level or in gliding flight angle, the struts, the wheel, step, or the wing may suddenly become an obstruction.

Although the photographer need not know a thing about flying the airplane, for general familiarization it will repay him to look through the Civil Aeronautics Administration Technical Manual No. 100, a flight instruction manual (Anonymous 1951), which may be bought at any airport or from the Superintendent of Documents, Washington, D.C., for $1.50.

The photographer may find that putting theory into practice when airborne is not an easy thing to do at first. Often the wing strut or the wing itself has a way of getting into the finder at the wrong moment. The pilot can

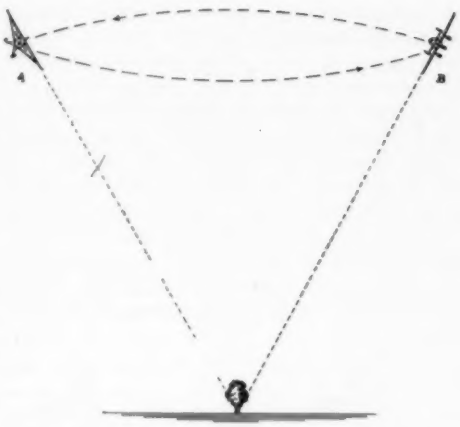

FIG. 10. A high wing (*A*) and a low wing (*B*) airplane circling around an objective in a moderately steep pylon turn.

improve the view by positioning the aircraft if he knows what the photographer is after. In some tandem seating aircraft, some photographs are more easy to take from the front seat, and some from the rear. This depends upon the position of the door, the position of the landing wheel, step, struts, and so on. If on a mission the desired angle comes to view and is missed, the flight must go around again to that selected point. The proper moment is a fleeting thing.

The low monoplane is preferred for the opportunity it offers to hold an unobstructed oblique view while turning around the objective in a "pylon" turn, keeping the same altitude at a constant bank with no wind (Figs. 10, 11). This turn can be made at steep to shallow angles, keeping the objective continuously lined up on the dipped wing tip. A high speed must be maintained at the steep angle in order to prevent stalling. However, at medium and shallow angles, a cruising speed may be kept. It is also possible to make a spiral turn with reduced throttle or glide around the objective. The advantage of the pylon or spiral turn around the site is apparent. This is especially so in pilot and cameraman side-by-side seating, since both have about the same line of sight on the pylon object. The site can be fixed in the camera view finder, and the proper moment for the shutter release can be made at leisure. Since the only movement of the objective is a slow angular turning on the negative, there is not much chance for blurring. Actually, it is one

way of pointing the camera. The photographer need only to train the camera on the objective and shoot at will. This requires precision maneuvering on the pilot's part. Presence of wind calls for drift allowances, therefore full 360° pylons around the objective at uniform banks are best maintained with little or no wind. However, the pilot can execute partial turns with fairly uniform banks in winds, which is all that is needed. In the high wing light monoplane, and the biplane, the pylon maneuver will not be ordinarily feasible for oblique photographs, since the wing strut or the wing itself will usually obstruct the field of view. It may be possible to shoot aft of the wing strut, permitting a pylon turn shot of the objective.

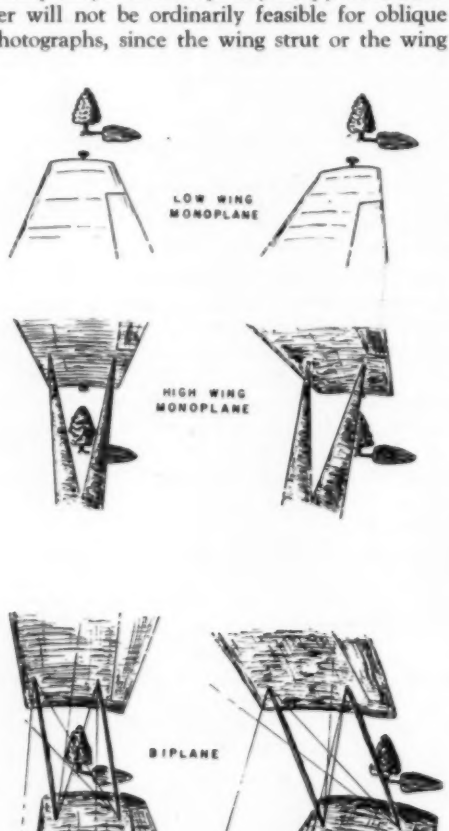

FIG. 11. Pylon seen from the front and rear seats of the low wing monoplane, the high wing monoplane, and the biplane, showing the views obtainable from the ordinary unmodified light airplanes.

In the high wing monoplane, in which obliques are made as the airplane approaches or leaves the site, the best photographs are made by following the objective with the camera until the proper moment is reached. With the camera on the objective, the photographer follows the site before, during, and after the exposure is made. This is called following through. The follow through, which may be likened to the highly necessary part of a golf swing, is very important. It obviates blurring. This type of action is also called panning, a technique especially familiar to race track photographers. The difference is that in the latter view, the object is really moving, whereas in the airplane technique, it is the airplane that is in motion. The photographer who wishes to practice this technique before taking to the air can easily do so from a rapidly moving train or automobile. He simply has to focus upon a suitably distant oncoming object in open country, and keep it fixed in his view finder until it is past. The direction of follow through of course, is the same as that in which the photographer is moving.

An attitude of "forward slip" may be of advantage if the photographer would like to take continuous shots dead on. In this maneuver, the pilot holds the ship on a single line of attack, aimed at the objective with the nose of the ship at a downward oblique to the left, permitting the camera operator to hold a fixed line of sight. The objective will get larger and larger as it is approached in the downward glide until the limit is reached and the pilot has to pull up and fly around again. This technique too, can be simulated from a moving automobile, shooting through the front window at some approaching object on the curb side.

For optimum results, the photographer and pilot should make a plan of campaign on the ground from the map study. The pilot should be firmly oriented regarding the site's location and know from what altitude and what angles the site should be shot. The time of arrival over the site should coincide with the best light conditions of the day, or the time of day desired. Minutes cost money in the air. However, the plan should be flexible because a better angle may present itself once over the site. Getting the plan of action and signals under-

stood before setting foot into the cockpit reduces the amount of talking above the engine noise to a minimum. A ground examination of the objective, if possible with the pilot, is very helpful to the latter. The pilot will understand more fully what the photographer is after, and will better appreciate the part he is to play in the action. The local terrain may include hills and other features such as high tension wires in the proposed flight line which may make an alternate viewpoint advisable. The photographer will find it rewarding to discuss the various flying attitudes useful for photography mentioned here with the pilot. It is just as simple for the pilot to execute one maneuver as another, and he will be most willing to oblige.

Thus, while it has been said that the pilot need not know a thing about aerial photography, nor the photographer need know a thing about flying, the truth is that if the pilot understands the photographer's problems, he can position his airplane and slow it down to the best advantage for the photographer. Similarly, if the photographer realizes what the airplane can do under various circumstances, and in what various attitudes it may be positioned, he can coordinate his activity with the pilot's actions better. Like the bombardier on a bombing run, the photographer calls the play once over the objective, calling for a gliding turn at reduced throttle around the objective, or a dead-on forward slip to the objective, or whatever maneuver is needed.

A word about the pilot's part. It is advisable to fly normally between 500 and 1000 feet above the ground on photographic missions with the ordinary type of camera for 2 reasons. One, all important, is that it is necessary for the aircraft to have the needed room for maneuvering for safety. Civil Air Regulations forbid airplanes to fly at less than 1000 feet over populated areas and at less than 500 feet elsewhere. The second reason is that the chances for blurred negatives are increased with low flying. The picture is the thing, and each shot should be well studied. The meanest gas tank will hold sufficient gasoline for at least 3 hours of flight. Hence there should be no need for haste once over the objective. The total time over the site on a mission will seldom exceed 20 minutes, if that.

A hundred feet or so may be lost in a gliding turn while the photographer is at work, which the pilot will regain before going around on the same run again. In a steep bank or a tight turn, keeping the same altitude, it is necessary to increase engine power because of the loss of wing lift, a maneuver which affects the photography because of the increased engine vibration.

For final review, let us consider the taking of an oblique exposure with the cameraman aloft in a high wing plane. After the photographer (or the archaeologist accompanying the flight) decides upon the point from which the picture is to be taken, he informs the pilot, asking for a forward slip or gliding turn (for instance). The pilot comes around to the vantage point the photographer has selected, keeping the objective on the cameraman's working side at the desired altitude. Just before reaching the selected point, the pilot reduces the throttle, placing the aircraft in a gliding angle, tipping the wing downward on the cameraman's side. This is where the expertness on the pilot's part comes in. He must control the attitude of the aircraft so that he will not cut off the view of the objective with any part of the plane. Meanwhile, the cameraman has readied his camera. He has set it up at the approximate angle at which the picture is to be taken, ready to follow through or to shoot dead-on as the case may be. He must be certain that no part of the airplane is in the angle of vision when he is making the picture. However, a wing tip framed in the corner of the finder might serve as an interesting composition, and gives a sense of perspective (Judd 1948: 111). For oblique views, the cameraman must be sure to hold the camera so that a side is parallel with the horizon regardless of the attitude of the aircraft. To level the camera when shooting low obliques, the camera should be first leveled with the horizon as a guide, and then carried downward to include the site area. Sighting with the wings as a guide will not help. When composition is satisfactory, and only then, the shutter should be released normally. I have found a cable release to be most advantageous in eliminating overly hard pressure (with possibly jerky movement of the camera) on the shutter release button. The click of the shutter will not be heard above the slipstream and engine noise. A visual check on the shutter release mechanism will be the only way of telling whether or not the exposure has been made on some cameras. The camera lens settings should be checked at intervals to be sure that they have not been accidentally

moved. A piece of drafting tape temporarily fixing the settings in place will help.

A record should be kept for reference of the speed of the aircraft, the altitude, the camera and film used, the lens and the settings, the time of day and date, the air conditions, the attitude (angle) of the aircraft, the pilot, and whatever particulars may seem necessary. Sources of error may be traced back to their origin if such a record is kept. In addition, for the sake of reference, the archaeologist-photographer should make careful note of the condition of the objective — whether the site is in planting, and what kind of crop, and so on.

Thus we see that there is more to taking aerial photographs than climbing into the cockpit of an airplane with a loaded camera and taking off. The archaeologist, who has to be on occasion surveyor, strawboss, public relations officer, reporter, and cameraman, in addition to his specialty of archaeology, need not become an expert aerial photographer. But he can come back with useful aerial photographs which will compare with the best.

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COLUMBIA UNIVERSITY
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CUCURBIT MATERIALS FROM THREE CAVES NEAR OCAMPO, TAMAULIPAS

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THE cucurbit materials identified and discussed in this report were excavated in 1954 by the third author from 3 caves in the Sierra Madre near Ocampo, Tamaulipas, 5000 feet above sea level (see Fig. 1). These caves were excavated by an expedition under the auspices of the American Philosophical Society, the American Academy of Arts and Sciences, the Botanical Museum of Harvard University, and the National Museum of Canada.

The first cave, called Romero's Cave (Tm c 247), had 16 stratified occupation layers. Most of these occupation layers contained preserved vegetable materials and revealed a sequence of 7 artifact complexes. These artifact complexes are called, from early to late, Infiernillo, Ocampo, Guerra, Mesa de Guaje, Palmillas, San Lorenzo, and San Antonio. The second cave (Tm c 248) contained 8 stratified layers belonging to 5 artifact complexes: Infiernillo, Ocampo, Flacco, San Lorenzo, and San Antonio. In the third cave (Tm c 274) vegetable materials were found only in the upper layers with the Palmillas and San Lorenzo artifacts, but below them Flacco and Infiernillo tools occurred. On the basis of these stratified data a sequence of 8 cultures has been determined and they are listed in Table 1 with tentative ages (MacNeish 1954).

The sites are on the northern edge of the area of great prehistoric cultural development of Mexico. Cultural connections with areas to the south are evident in the last 4 cultures, but they are probably differentiated from these to the south by a noticeable lag in time. The first 4 cultures or phases at Ocampo have no cultural equivalents to the south but do have them in the Sierra de Tamaulipas to the east (MacNeish 1950, 1955).

THE ARCHAEOLOGICAL SEQUENCE

The earliest cultural remains, of the Infiernillo phase, represent wild-plant collectors who did some hunting. Two radiocarbon dates, one (M-500) from the lowest level of Cave Tm c 274 and another (M-498) from vegetable materials surrounding actual squash specimens in the next to lowest level of Tm c 248, yielded ages of 8540±450 and 8200±450, respectively. On this basis Infiernillo is tentatively dated 7000 to 5500 B.C. A few pods of jack beans (probably wild) and squash "rinds" and seeds occurred at the latest level. The artifacts consist of an extensive series of very large and crude choppers and scrapers, a few diamond-shaped and leaf-shaped dart points, checker-woven mats, and a few distinctive nets and twined baskets.

The Infiernillo remains seem to grade into those of the Ocampo phase, representing another group of basically wild-plant collectors though remains of pods of jack beans, common beans, and quite a bit of squash suggest some planting. Large triangular and leaf-shaped atlatl dart points, as well as crude choppers, gouges, and scrapers occur, and there is a series of new string, basket, mat, and net types, and many wooden tools. Dating of this culture has a fairly sound basis in 3 radiocarbon dates for this period as well as 2 dates that may be cross

FIG. 1. Outline map of Tamaulipas, Mexico, showing the approximate location of the Sierra de Tamaulipas caves (x), and the Ocampo caves in the Sierra Oriental (y). Inset shows position of Tamaulipas in black.

* We are indebted to the John Simon Guggenheim Memorial Foundation for assistance in carrying out this work.

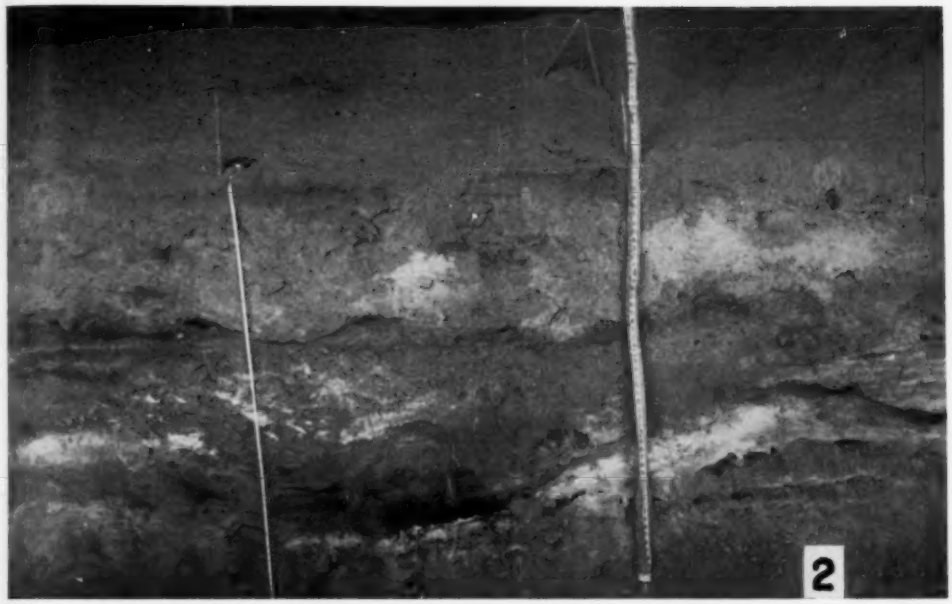

FIG. 2. Excavations at the Ocampo caves. Vertical wall of a trench in cave Tm-c-274, showing superimposed charcoal floors. The distance between the 2 white vertical markers is 5 feet.

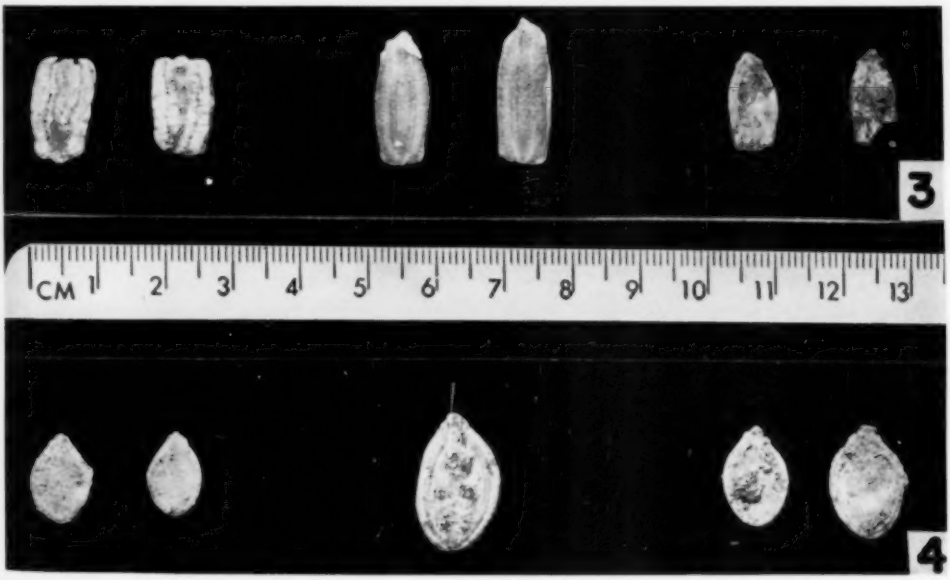

FIG. 3. Seeds of *Lagenaria siceraria*. *Left*, 2 seeds of the broad, corky, winged type common in Asia; *center*, 2 seeds of narrow, slender type similar to those from Africa and the New World; *right*, 2 seeds from the Ocampo caves, Mesa de Guaje culture.

FIG. 4. Seeds of *Cucurbita pepo*. *Left*, 2 seeds from the Infiernillo culture, note small size; *center*, one seed of a modern variety from the San Lorenzo culture; *right*, 2 seeds from the Mesa de Guaje culture.

dated with these remains. Remarkably enough, all five seem to agree. Carbon specimens from Level 8 (M-503) and Level 11 (M-502) of Tm c 247 and vegetable materials, including squash from the middle levels of Tm c 248 (M-497), give dates of 4580±350, 5230±350, and 5650±350. Another specimen, from La Perra Cave (Libby 1952: 679-80, sample C-687), as well as one from the Falcon Dam of Texas associated with a cultural complex very similar to late Ocampo materials, give dates of 4445± 280 and 4650±300. On the basis of these dates it is estimated that the Ocampo horizon extends from 4000 to 2300 B.C.

Flacco, in turn, developed from Ocampo. The chopper types had diminished in frequency and new types of dart points, with small contracting stems, string, baskets, twilled mats, nets, and scrapers had appeared. Though most of the diet of the Flacco people still consisted of wild food plants, a fair number of bean pods, beans, and fragments of squash, as well as one or 2 fragments of very primitive (Bat Cave?) corn, were found. The estimated age of this culture, 2300 to 1800 B.C., is based upon a radiocarbon determination of 3945±334 by the University of Chicago on Flacco levels from Tm c 248.

Guerra is the next phase in time. Besides wild food plants, bean pods, common beans, corn of Bat Cave type, much squash and gourds, and some fragments of woven cotton were found. Distinctive small triangular and leaf-shaped projectile (dart) points, baskets, nets, mats with decorated edges, string, and wooden tools occur. This culture, as well as the previous one, may haye been contemporaneous with the beginning of village life and pottery making farther south in Mexico from 1800 to 1400 B.C. One carbon sample (M-504) from Level 6 of Tm c 247 gives a date of 4730 ±300. This date seems to be too old and does not fit with the other dates from the stratified levels of this cave.

The next culture, Mesa de Guaje, saw the introduction of pottery, figurines, and village life to the area and it had many cultural affiliations southward. The peoples were agriculturists and grew corn (with teocentli), jack, common, and lima beans, squash, gourds, and cotton. Artifacts include loom-woven cotton cloth, a large series of distinctive nets, mats, handmodeled figurines, split-stitch baskets, straight-stemmed, triangular dart points, small, ovoid dart points, and wooden tools. One sample of these remains (M-505) from Level 4 of Tm c 247, has been dated on 2 runs to 3650±250 and 3440±250 years ago. These seem slightly old for the horizon, which is estimated to last from 1400 to 400 B.C.

One specimen (M-506) from Level 3 of Cave Tm c 247 gives a date of 1720±150 for a Palmillas phase level and the estimates for this period run from A.D. 150 to 850. The Palmillas phase is the cultural apogee of the area and saw the construction of large towns (or cities?), stone pyramids and house platforms, the introduction of tobacco, platform pipes, and cigarettes, the bow and arrow, finer cotton weaving, complexly woven mats, various kinds of string, serrated corner-notched projectile points (both arrow and dart), and moldmade figurines. The means of subsistence was agriculture as in the previous period. This culture complex appears almost identical with that of the Zaquil period (Period IV of the Huasteca) and parallels the late Classic period of the rest of Mexico (Ekholm 1944:352-8, 427).

San Lorenzo had a similar subsistence but the cultural materials were definitely more poorly made. They include corrugated and brushed pottery, many notched and triangular arrow points, simple twilled mats, cotton weaving, and a host of small scraping tools. One specimen (M-501) from Level 1 of Tm c 274 yielded a radiocarbon age of 520±200. Therefore, we have estimated that this culture lasted from A.D. 1050 to 1450.

San Antonio, which lasted into historic times, was a continuation of the previous culture. The material culture was even less complex, and the villages were smaller and without stone construction. Generally speaking, there is good evidence for cultural continuity with change brought about by internal development and by diffusion of culture from the south.

Identification of the Cucurbit Materials

Cucurbit materials were found in comparative abundance in all the cultures listed and in considerable diversity in some of them. Most of the material consists of the dry, hardened "rinds," or "shells," of the fruits, but seeds and peduncles were frequently present in quantity.

Table 1 summarizes the identifications. Rinds of *Lagenaria siceraria* (Mol.) Standl., were found at all cultural levels, but seeds were recovered from 2 levels only. Rinds and seeds of

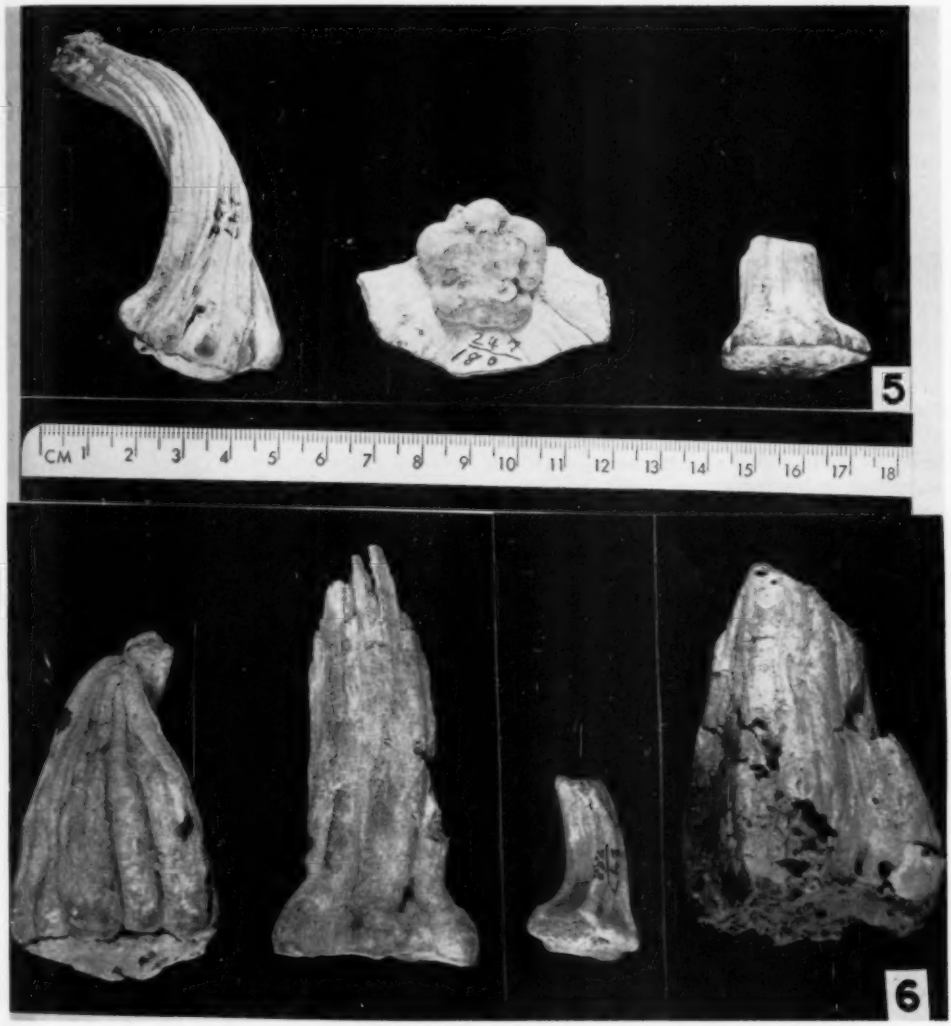

FIG. 5. Peduncles of *Cucurbita pepo* and *C. moschata* from the San Lorenzo culture. *Left*, peduncle of *C. pepo*; *center and right*, peduncles of *C. moschata*.

FIG. 6. Peduncles of *Cucurbita pepo* and *C. mixta*. *Left* and *center*, 3 peduncles of *C. pepo* from the Palmillas culture. Variability in morphology suggests that several varieties were grown. *Extreme right*, peduncle of *Cucurbita mixta* from the Palmillas culture.

a wild species of *Cucurbita* (probably *C. foetidissima* HBK.) were present in 7 cultural levels. However, in the Infiernillo phase only seeds and in the Palmillas phase only rinds were found. Peduncles of this group of plants were not present in the excavated material, most likely because the fruits were gathered when mature. At maturity the peduncle separates readily from the fruit, and may be broken off or lost. Rinds of *Cucurbita pepo* L. were found in all levels except the latest (San Antonio), while seeds were present in all levels. Peduncles of this species were identified from all but the 2 oldest cultures (Infiernillo and Ocampo). Rinds of *C. moschata* Duch. were identified from three of the later cultures, seeds from one, and peduncles from four or possibly five. The only positive evidence of *C. mixta* Pang. is a peduncle of a variety of this species at the Palmillas cultural level, but 2 seeds in material from San Lorenzo were tentatively identified as belonging to this species.

Discussion

1. *Lagenaria siceraria* (white-flowered gourd, bottle gourd). The ubiquitous occurrence of *L. siceraria* and the shape of the rind fragments suggest that fruits of this species were used as containers of various sorts, as cutlery, and as rattles. They continued to be used even after the development of pottery. For some reason only 3 seeds were found. This curious fact may indicate that seeds were used for food, and consequently not preserved.

The occurrence of *L. siceraria* at the lower levels of these sites and at Huaca Prieta (Whitaker and Bird 1949) indicates that this species was established in both North and South America at a relatively early date. It also supports the idea that this species was carried to the Americas by oceanic drift as suggested by Towle (1952:182) and sustained by the experimental investigations of Whitaker and Carter (1954), and not brought to this hemisphere by pre-Columbian Transpacific voyagers. Further support of the theory that *L. siceraria* arrived in the Americas independently of man is found in the gross morphology of the seeds. The blocky, soft, corky-winged seeds of *L. siceraria* types common in Asia are not found in the New World. On the other hand the slender, hard, and almost wingless seeds of the New World types resemble some of those found in African types (see Fig. 3).

2. Wild *Cucurbita* species (calabazilla, wild gourd). Seeds, fruits, and roots of several wild species of *Cucurbita* are used over a wide area by the Indians of Mexico and the southwestern United States. The wild *Cucurbita* species are difficult to distinguish from seeds and rinds alone. Positive identification requires specimens which include leaves and flowers. In addition, many of the wild species will hybridize among themselves and with cultivated species (unpub-

Table 1. Identification of the Cucurbit Materials from Various Cultural Levels in the Ocampo Caves.

Culture	Tentative age years	Lagenaria siceraria			C. foetidissima			C. pepo			C. moschata			C. mixta			Total specimens in each culture
		R	S	P	R	S	P	R	S	P	R	S	P	R	S	P	
San Antonio	200 to 500	151		1	9	3			3	3	1	1	3				175
San Lorenzo	500 to 900	235	1	1	40	2		31	45	10	6		3		21		376
Palmillas	1100 to 1800	104			9			5	2	5	5		3			1	134
Mesa de Guaje	2400 to 3400	17	2		6	11		2	96	2			2				138
Guerra	3400 to 3800	43			10	1		30	39	3			17				127
Flaseo	3800 to 4300	4			67	6		38	11	6							132
Ocampo	4300 to 6000	87			19	3		15	13								137
Infiernillo	7500 to 9000	2				6		1	7								16
Total number of specimens of Cucurbita spp. and L. siceraria																	1,235

R= "rinds" or "shells"; S = seeds; P = peduncles

lished data) and the progenies from such crosses are rather variable. Since *Cucurbita foetidissima* is the most widespread and most variable of all the wild species, and as it grows in the vicinity of Ocampo (the type locality being "Near Guanajuato, Mexico") we have given this name to the material from the caves even though it possibly comes from other wild species of this group.

3. *Cucurbita pepo* (pumpkin and squash). *Cucurbita pepo* specimens from the Ocampo caves are the oldest yet found in North America and antedate the remains of this species found in Tularosa Cave, and Bat Cave (Cutler 1952; Smith 1950). *C. pepo*, the most widespread cultivated species in North America, has been obtained from Indian tribes or found in archaeological sites from Canada to Guatemala. This broad distribution is probably a result of the antiquity of *C. pepo*.

The peduncles and seeds of *C. pepo* found in the oldest levels of the Ocampo caves are small compared with those of most present-day varieties (Fig. 4). All the fruits were probably small, and perhaps were harvested when green as are some varieties grown by natives of Central America and Mexico today. By the time of the Guerra culture (1800 to 1400 B.C.) several varieties were grown. This variability reaches a peak in the Palmillas culture (A.D. 150 to 850), and then declines (Figs. 4 and 5). The peak diversity of this species coincides with the period when it is believed that the culture of the Ocampo cave dwellers attained its maximum development.

The fact that corn did not appear in the Ocampo cave sites until Flacco culture (2300 to 1800 B.C.), at least a 1000 years after *C. pepo* indicates that *C. pepo* antedated corn at this site. The same sequence occurred at Huaca Prieta (Whitaker and Bird 1949), where *C. ficifolia* Bouché and *C. moschata* antedated corn. These 2 sets of observations are significant because they suggest that corn and the 3 squash species did not originate at the same place, or if they did originate in the same area, that they were not domesticated simultaneously.

4. *Cucurbita moschata* (squash, pumpkin, and cushaw). The center of diversity of *C. moschata* is in Central America and northern South America. At Huaca Prieta in Peru (Whitaker and Bird 1949) *C. moschata* was found at levels of approximately the same age as the lowest levels of the Ocampo caves or slightly earlier. In the Ocampo caves, *C. moschata* appears definitely in the Mesa de Guaje culture (1400 to 400 B.C.), and there is a peduncle which is probably *C. moschata* in the Guerra culture (1800 to 1400 B.C.) These are the oldest *C. moschata* remains found in North America up to the present. Peduncles of *C. moschata* were found in all of the later cultural levels (Fig. 5).

To the north, *C. moschata* first appeared about 1000 years ago and spread over a small part of the area in which *C. pepo* was grown. The limited distribution of this species is probably correlated with a lack of tolerance to low temperatures (Whitaker and Bohn 1950).

5. *Cucurbita mixta* (squash and pumpkin). *Cucurbita mixta* is found only in the Palmillas culture (A.D. 150 to 850), somewhat later than *C. moschata* and much later than *C. pepo* (Fig. 6). This collection may be the oldest *C. mixta* yet discovered. Two peduncles from Ventana Cave (Haury 1950), identified as *C. moschata* at a time when *C. mixta* was not recognized as a valid species, may be as old, but the dates for the Ventana Cave peduncles could not be determined accurately.

Cucurbita mixta spread to the north later than *C. moschata*. Specimens of this species are found in the Verde Valley, Montezuma Castle, and in San Juan River sites after A.D. 1200 (unpublished identifications). The Hopis and Taoseños grew *C. mixta* before Europeans arrived. Like the distribution of *C. moschata*, that of *C. mixta* was limited perhaps by its sensitivity to low temperatures.

SUMMARY

A sequence of 8 cultures of artifact complexes excavated from 3 caves near Ocampo, Tamaulipas, Mexico, were determined on the basis of stratigraphy. Tentative dates and significant artifacts for each culture are given.

A study of the cucurbit materials associated with the various cultures yielded the following information.

Lagenaria siceraria and wild *Cucurbita* species are found in all of the 8 cultural levels at this site.

Cucurbita pepo is found at all levels, the specimens from the lowest levels being the oldest yet recorded. This species reaches its greatest diversity in the Ocampo cave sites at the time of highest cultural development.

Cucurbita moschata came in much later than C. *pepo*, but the specimens are still the oldest yet know in North America.

Cucurbita mixta occurs later than C. *moschata*, but the specimen is probably older than any other specimens discovered so far.

The materials from this site substantiate the hypothesis that C. *pepo* was widely distributed over North America at an early date, that C. *moschata* came in later, and that C. *mixta* is an even more recent introduction. The last 2 species never attained the wide distribution of C. *pepo* in North America.

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THE ISLAND 35 MASTODON: ITS BEARING ON THE AGE OF ARCHAIC CULTURES IN THE EAST

STEPHEN WILLIAMS

THE possibility of the contemporaneity of man and the mastodon in America has been a vexing one for more than a hundred years. In 1839 Albert C. Koch first reported that he had found evidence to support such a claim (Montagu 1942); and the situation today remains much as it was then, confused and without absolute certainty. It would, perhaps, be worthwhile at the outset to make explicit the distinction between the mammoth and the mastodon. Mammoths are fossil elephants, family Elephantide, which were restricted in the New World to North America. The American mastodons are Pleistocene survivors of a large, varied, and widespread family distinct from the elephants proper. In speaking of late Pleistocene mastodons, the American Mastodon, *Mammut americanum*, is invariably meant. Mammoths and mastodons can be immediately distinguished on the basis of easily recognized differences in their molar teeth. This study deals exclusively with the mastodon and its occurrence with evidences of man in North America.

Independent data seem to place man on this continent when the mastodon still roamed here; but unimpeachable physical evidence of their coexistence, such as a definite mastodon "kill" site like the Naco mammoth find in Arizona (Haury 1953), remains to be discovered. Rather we have a series of finds which must be considered carefully and with an open mind in order to assess their relative merit. The purpose of this article is to add the Island 35 mastodon and its 2 possibly associated artifacts to this series and to try to make some general conclusions on the basic problem.

THE ISLAND 35 MASTODON

Location. In 1900 the late Dr. James K. Hampson found remains of a mastodon at the head of Island 35 in Tipton County, Tennessee (site 10-Q-7 of the Lower Mississippi Survey), 23 miles south of Blytheville, Arkansas (Fig. 1). Prior to 1890 the main channel of the Mississippi River ran close to the bluff at Richardson's Landing and to the west of Island 35. There was a large sandbar of some 75 acres at the head of the island which was exposed at low water. Considerable bank caving took place about this time and shortly afterward the river's major course changed to that which it now maintains. Thus today the site has been destroyed and it is even difficult to relocate it on a map.

Circumstances of Discovery. In 1900 there was a high June rise of the river. When the water subsided in the first part of July, the mastodon skeleton was uncovered in gravels where the sand of the point bar had been swept away. John Pendleton, a neighbor who lived on the island, told Hampson about the exposed bones and aroused his interest.

Hampson managed to visit the site some 2 or 3 weeks after its initial discovery and saw what remained in the gravel. Curiosity seekers had done considerable damage to the specimen, but Hampson recovered what was left. He found a tooth which had been knocked out of the skull with an ax by "ivory hunters." The remaining bones, mainly part of the hind leg and pelvis, had to be excavated with a pick, as the gravel in which they were lying was made up of water worn pebbles cemented together by a clay. This circumstance made it very difficult to

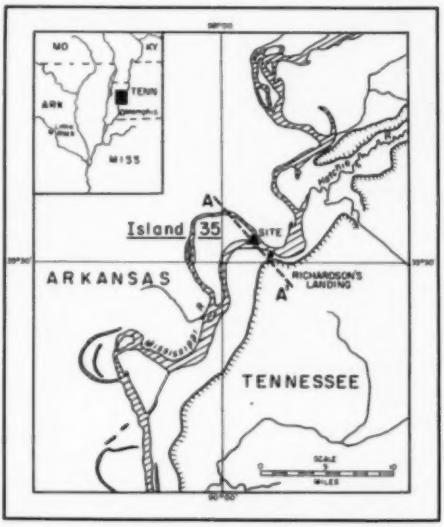

FIG. 1. Location of Island 35 site, Tipton County, Tennessee.

remove the bones, which were also held fast by the clay. Immediately under what remained of the pelvis he discovered 2 artifacts: a projectile point and a large scraper. The bones were found in an area about 12 feet square, and the whole site was searched for 2 days for further evidence of man. However, no signs of occupation, no burnt stones or charcoal, were found.

Mastodon Remains. The mastodon find seems to represent at least one complete and previously articulated animal. Hampson saw other parts of the skeleton, including some of the vertebrae which were being used by an old lady on the island to border her garden. He saw a part of the skull which had been removed from the site and also several ribs.

The bones now available for study appear in Figure 2 and measurements are given in Table 1. The rather worn and considerably damaged third molar was identified as mastodon, *Mammut americanum*, by Edwin H. Colbert of the American Museum of Natural History and Donald Baird of the Museum of Comparative Zoology, Harvard University. The bones include the left ilium, the left femur, and the left ulna of a mature adult, which appear to go with the molar. A fourth bone has been identified as a right ulna of a younger animal, indicating the presence of a second mastodon.

TABLE 1. MEASUREMENTS ISLAND 35 MASTADON

Left Femur:	
Total length	75.0 cm.
Midsection circumference	31.5 cm.
Midsection diameter	12.5 cm.
Width at distal end	17.0 cm.
Width at proximal end	18.5 cm.
Left Ulna:	
Total length	52.0 cm.
Midsection circumference	33.5 cm.
Midsection diameter	10.0 cm.
Width at distal end	12.0 cm.
Width at proximal end	24.0 cm.
Right Ulna:	
Total length	46.0 cm.
Midsection circumference	29.0 cm.
Midsection diameter	9.0 cm.
Width at distal end	10.0 cm
Width at proximal end	18.5 cm.
Left Ilium:	
Anterior-posterior	58.5 cm.*
Greatest diameter of ilium above acetabulum	20.0 cm.
Third Molar:	
Height	17.0 cm.
Length	11.0 cm.
Width	8.0 cm.

From a paleontological viewpoint there is nothing to indicate that the bones did not all come from the same deposit, as shown by their similar condition and coloration. All show a similar degree of what may be abrasion and also a surface pitting which may indicate gravel impressions. All the bones were considerably damaged in excavation and as a result have lost most of their articulatory surfaces, so that the measurements now available are of but little comparative value.

Artifacts. The projectile point is 48 mm. long, approximately 30 mm. wide at the shoulder, and averages 6 mm. in thickness (Fig. 3 *a*). It was broken in use, as the stem is missing, and a large flake was accidently removed during excavation. The core revealed in this flake scar shows the considerable patination of the original surface. The point exhibits quite large primary flaking technique and some secondary retouching along the edges and at the base.

The scraper is a much cruder tool with percussion chipping used to fashion the basic shape and then pressure flakes removed along the long sides. It is 87 mm. long, 55 mm. wide, and 30 mm. thick (Fig. 3 *b*). It is also a brownish chert, the material possibly derived from river gravels.

Both artifacts exhibit considerable surface polish and the chipped edges are somewhat dulled. This condition has *not* been caused by rolling in the opinion of Hallam L. Movius, Jr., Peabody Museum, and John P. Miller, a geologist, also at Harvard (personal communications). Movius suggests that the surface condition might have been produced by the percolation of fine-grained deposits while the specimens were in place, while Miller suggests that the character of the surface may be due to deposition of silica from percolating ground water. Similar chemical changes may also have caused the smooth condition of the mastodon bones. Both agree, however, that rolling by water action is not indicated.

The projectile point, with a broad, almost triangular, blade and probably a straight stem, is certainly not a type usually thought of as early in North American sequences. The scraper, so crude that it could almost have been made on

the spot, has no close typological parallels of which I am aware. The chronological significance of these artifacts will be dealt with in a later section.

Geological Implications. No precise geological section is available for Island 35, but the gravels such as those in which the mastodon was found make up the bulk of the late alluvial fill at the north end of the valley, according to Fisk (1944: 17). However, these gravels are all well covered by a finer alluvial soil, no less than 25 to 30 feet thick. In the Island 35 area the top of these gravels is approximately 200 feet above mean sea level (Fisk 1944, Pl. 12, *Sheet 1*). The mean low water level at this point in the valley is just above 200 feet (Fisk 1944, Pl. 25), so it is easy to see how such gravel beds could be exposed (Fig. 4). These figures and the cross section are given in approximate terms since the nearest available log of borings applicable to the Island 35 area is that from the Mississippi River Commission's District Office at Memphis, for the Keyes Point revetment some 20 river miles to the north. Also the detail on Fisk's maps cited above is not sufficient for finer correlations. The head of Island 35 is, moreover, cut by a number of recent channel beds (Fisk 1944, Pl. 22, *Sheet 3*), and it is only by the slightest chance that one of these channels did not swing across and destroy the site long prior to the turn of this century.

The site situation can be reconstructed with these data to indicate that the skeleton of the mastodon and the 2 artifacts were originally on a gravel island in the middle of the braided Ohio River channel. With a rise in sea level, subsequent alluvial deposition in this area was made up of finer silts and sands which covered the site. Much of this later alluvium was removed by recent scouring by a Mississippi River channel. The skeleton was exposed once again when the last of the overlying sand was swept away by the flood in 1900.

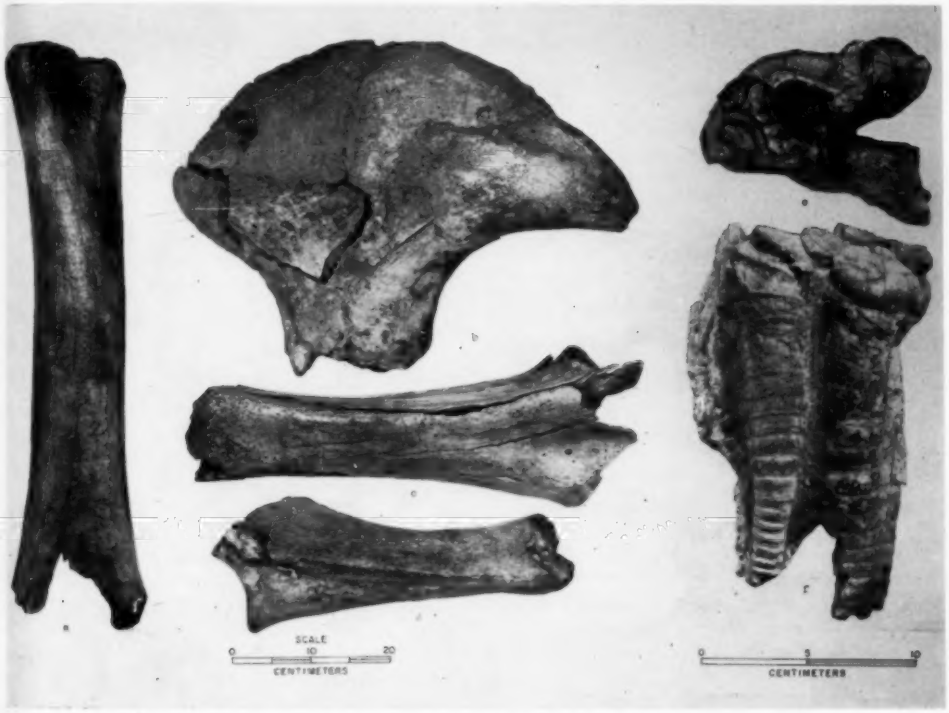

FIG. 2. Mastodon bones from the Island 35 site. *a*, left femur; *b*, left ilium; *c*, left ulna; *d*, right ulna; *e*, top view of third molar; *f*, side view of third molar. (Scale at right applies to *e* and *f*.)

As to age Fisk (1944: 38) indicates that the old Ohio channel kept bringing gravels into this general area until a –55 foot sea level was reached. This situation would place a possible terminal date on the find of about 10,000 years ago (Fisk 1944, Table 3). This estimate was, however, made in preradiocarbon days and probably would have to be slightly revised.

Comparative Material

Other Mastodons in the Mississippi Valley. Nearby at Truman, Poinsett County, Arkansas, a fragment of a mastodon tooth and a dorsal vertebra were found in a gumbo soil at a depth of about 12 feet during a drainage canal excavation in 1921. There is no indication of its geological age. Before 1889 at Helena, Phillips County, Arkansas, another possible find was made in clay 50 feet deep overlain by loess. However, no precise identification as to whether it was a mastodon or one of the elephants is available. A third find in Arkansas was made in the Mississippi River in Chicot County when an upper second molar of a mastodon was taken from river gravels in 1922 across from Greenville, Mississippi, but since it was found in a load of gravel no geological age determination can be suggested (Hay 1924: 22).

On the other side of the river was a find of some mastodon teeth at Memphis, Shelby County, Tennessee, reported in 1850 by Jeffries Wyman and associated with other Pleistocene fauna (Hay 1923: 128). To the south, a fragment of an upper 3rd molar of a mastodon was sucked up with gravel from the Mississippi river near Perthshire, Bolivar County, Mississippi (Hay 1923: 124). This brief survey is of little archaeological significance except to indicate that a number of mastodons have come to light within the alluvial valley of the Mississippi. I have personal knowledge of several other purported finds of mastodon from this area, so the Island 35 find is by no means unique. In at least 2 cases teeth came from river gravels revealing a situation which may be analogous to that under which the Island 35 mastodon was found.

Koch's Missouri Mastodons. In direct contrast to this scattering of mastodon finds in Arkansas and western Tennessee, at least 19 sites have been definitely recorded for Missouri (Hay 1924: 24-33). This discussion will be limited to a pair of discoveries made in 1838-40 by Albert C. Koch (1860a, 1860b), a German immigrant of considerable energy and with some excavation skills.

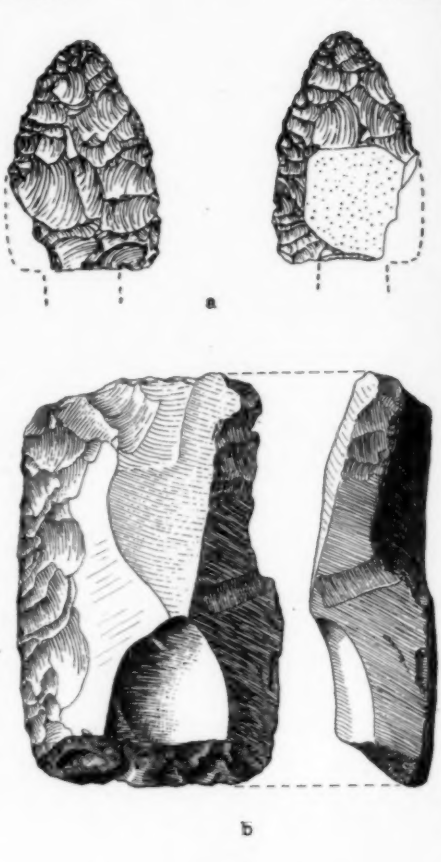

Fig. 3. Island 35 artifacts. *a*, projectile point; *b*, scraper.

In October, 1838, Koch found the complete skeleton of a mastodon near Bourbeuse Creek, Gasconade County, Missouri. The animal had been mired in clay and then attacked with fire, stone implements, and rocks. Koch found a number of implements including 2 axes, a spear point, and 5 projectile points. Needless to say Koch's claim for the coexistence of man and fossil animals was widely publicized and as widely discredited for many decades. A re-

evaluation of Koch by Montagu and Peterson (1944) does not minimize Koch's tendency for exaggeration but does show that all of his work cannot be summarily dismissed, and this sentiment has been recently repeated (Gross 1951: 102).

Further interest in this Gasconade County find has been evoked by the publication in 1951 by Hugo Gross of photographs of 4 projectile points from this site given to the Royal Museum of the University of Berlin. These points are quite similar in appearance, with a broad blade and a short stem (Fig. 5 *a-d*). Montagu and Peterson (1944: 410) suggest that the animal discovered was in fact a ground sloth (*Mylodon harlani*), but Gross (1951: 103, footnote 2; 105) disagrees and states that it was undoubtedly a mastodon. Koch (1860b: 117-8) definitely stated that the artifacts and skeletal material from the Gasconade County find were at the Berlin Museum, and Gross was able to find only mastodon bones in the collections attributed to Koch at this museum. Gross (1951: 124) inadvertently ascribed all 8 projectile points at the Museum to the mastodon site, although he previously presented data to indicate that the other 4 (Gross 1951, Pl. 18 *E-H*) were actually from Hermann, Gasconade County, Missouri, on the Mississippi River about 25 miles due north of Bourbeuse Creek and therefore seem to have no direct bearing on the mastodon find.

A further discovery by Koch made his case even stronger when he uncovered an almost complete skeleton of another mastodon near the Pomme de Terre River, Benton County, Missouri, in 1840. This mastodon later became a major exhibit in the British Museum, the first to be displayed in Europe. While excavating he found one projectile point in close association, lying underneath the femur, and four more nearby (Montagu and Peterson 1944: 409). Later Koch (1860a: 63) mentioned 2 points definitely found with this mastodon. One of these points was illustrated by Rau (1873: 396) and has a triangular blade and broad stem (Fig. 5 *e*). Montagu and Peterson (1944: 419) were not aware of the existence of this point, but indicate that in 1926 W. H. Holmes talked of having seen, at the Missouri Historical Society about 1890, what seems to have been a fluted point, which was purported to have been associated with the Koch mastodon. A limited search of this institution's collections by this author was entirely negative, for although numerous fluted points from Missouri were encountered, none could be assigned to this find.

Both of these mastodon finds by Koch must be viewed with caution. There is no precise geological evidence for dating them and it is impossible to be positive at this late date of the association of the artifacts. However, it seems difficult to accept the hypothesis by Gross

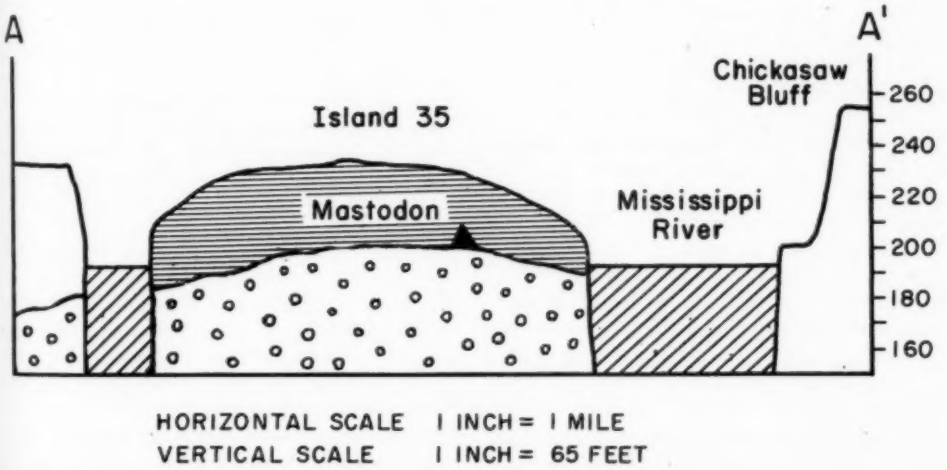

FIG. 4. Reconstructed cross section A-A' at Island 35 locality. (See Fig. 1 for location.)

(1951: 103, 124) that the Gasconade County mastodon skeleton was exposed by a spring freshet and then found by later Indians who burned it and threw stones at it. The Koch finds have not been made easier to assess by an error which appeared in a recent paper about them. Montagu and Peterson (1944: 415) refer to the Gasconade find (their ground sloth) and then inadvertently quote from Koch's description of the Benton County mastodon find as if the reference described the former. Whatever one thinks of Koch, these artifacts, found independently, are enough like the Island 35 specimen to warrant further study.

Other Evidence of Man and Mastodon. A brief review of other pertinent finds seems now in order and will be dealt with chronologically. I have relied on Wormington (1949), Macgowan (1950), Sellards (1952), and Daugherty (1956) in this survey of the literature, and more extensive bibliographic references to most of these finds will be found in these works.

A human pelvis and numerous fossil remains came to light at Natchez, Mississippi, in the 1840's. The pelvis appears to have come from the same layer of clay which underlies the loess in that area, and which contains mastodon bones as well. An early attempt at fluorine dating showed the skull to be similar in age to one of the fossils. Quimby (1956) has made a recent survey of the area and sees no reason to doubt their contemporaneity.

At Trenton, New Jersey, finds at the Abbott Farm site during the period of 1872-79 included human skeletal material, stone artifacts, and mastodon remains. Modern excavations at the site (Cross 1943, 1956) may be termed inconclusive on this point but Schmitt (1952) definitely felt that there was an Archaic complex present. Thus although the mastodon's association with man and artifacts is by no means clear cut, if there were such an association, it would probably be with Archaic materials rather than those of early man.

In 1884 in Northboro, Worcester County, Massachusetts, a human skull was found lying on blue clay in a peat bog about 18 feet from the skull and teeth of a mastodon also lying on the clay (Putnam 1885). The bones of both seem to have been deposited in the clay by water action and the question of their true contemporaneity would seem insoluble at this time, without new data such as a fluorine test.

Another site at which man and the mastodon seemed to coexist which caught Putnam's interest was Potter Creek Cave, Shasta County, California (Putnam 1906). Here pieces of splintered bone were found among a large amount of extinct fauna including mastodon. Krieger (1953: 240) has recently revived interest in this find and is convinced that the bone objects are indeed artifacts, and this identification appears well founded.

Human skeletal remains and artifacts have been found in Florida at the Vero and Melbourne localities under circumstances which suggested that they might be contemporary with fossil forms, including the mastodon, occurring at the same sites (Sellards 1952: 127-8). Irving Rouse (1950, 1951) has reviewed the situation very thoroughly and has concluded that the human materials are intrusive into the Melbourne formation, the fossil bearing layer, at the Vero site, but that the Melbourne skull might be from this layer (Rouse, personal communication). The fluorine tests which have been run on the bone material are not conclusive (Sellards 1952: 90-4). However, a recent discovery of stone artifacts from this same Melbourne formation (Rouse 1952: 294), which have not yet been described, strengthens the evidence for man's contemporaneity with the mastodon in Florida.

The Sandia Cave, Sandoval County, New Mexico, represents another site at which remains of man and the mastodon have been found in the same level. Here the distinctive stemmed Sandia points were found with other evidence of man in the deposits containing mastodon bones. A recent discussion of these finds (Hibben 1955) has been occasioned by radiocarbon dates for this level. This situation will be discussed further under chronology.

Another find of interest is that at the Polecat Creek gravel pits, Coles County, Illinois (Galbreath 1938). From the alluvial gravels came the incomplete left mandible of a mastodon and also the left mandible of a member of the Canidae family which has been identified as domesticated dog (*Canis familiaris*) with some assurance. There was also a fragment of human skull probably, but not certainly, from these same gravels. The questionable nature of this last association results from the nature of the collecting conditions. There is rather unaccountably among the other fossils the vertebra of a muskox and also bones of the modern

bison. This potpourri of fossil material is of considerable interest but future work at the site by both paleontologists and archaeologists appears required before its full potential, which includes material for pollen analysis, is realized.

In the fall of 1930 a mastodon was discovered near Cromwell, Noble County, Indiana, and subsequently excavated by the Buffalo Museum of Science (Burmaster 1932; Sanford 1935). It has been designated the "Richmond Mastodon." This animal was found lying in peaty clay deposits of an ancient pond and with evidence of fire in the form of charcoal and a burned log. From this same layer and the muck above came 2 corner notched projectile points (Fig. 5 *g, h*) which Sanford felt were associated with the mastodon. Neither point was closer than 15 feet to the skeleton and I must agree with Gross (1951: 110-2) that the projectile point association is somewhat tenuous, although the charcoal around the specimen is hard to explain, and these data may in fact indicate the presence of man coeval with the mastodon.

Two sites in Texas have produced further evidence which is pertinent to the problem. The Bee County finds (Sellards 1940) indicate numerous human artifacts from the Berclair Terrace which also contained mastodon remains at Sites 1 and 12. Site 12, which produced a rather complete skeleton of a mastodon from this formation, unfortunately did not contain any artifacts. Site 1, the Buckner Ranch, contained several mastodon teeth and 2 stemmed projectile points with side notches (Sellards 1940, Pl. 1, 6) as well as a fluted point and others then identified as Yuma. Clearly these water-laid deposits present certain interpretive problems, but the clustering of finds at Site 1 (Sellards 1940, Fig. 4) seems to indicate human agency at work in part of the depositional pattern.

A recent appraisal of the site (Suhm and Krieger 1954: 120-1) includes a classification of the projectile points according to present

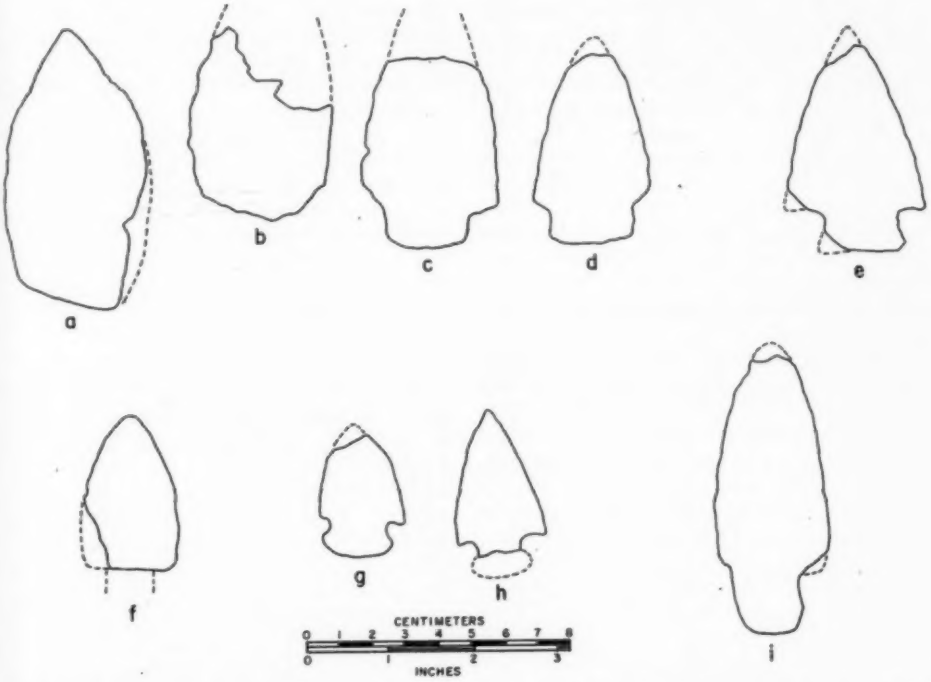

FIG. 5. Projectile points possibly associated with mastodons in the eastern United States. *a-d*, Bourbeuse Creek, Gasconade County, Missouri; *e*, Pomme de Terre, Benton County, Missouri; *f*, Island 35; *g-h*, "Richmond Mastodon," Noble County, Indiana; *i*, Orleton Farms, Madison County, Ohio.

usage and some explanations for the mixture of these projectile point types. One suggestion that is offered would require the Archaic type of projectile point with side notches be coeval with Scottsbluff, Clovis, and Folsom types, and with the mastodon as well. This hypothesis is quite close to that developed later in this paper, but the Buckner Ranch sequence could be accounted for by mixing of materials in the lower gravels despite the hearths which are in place in the overlying silts.

Friesenhahn Cavern (Sellards 1952: 94) appears to have a rich Pleistocene fauna with mastodon among the identified forms and with a number of artifacts in close association, but no detailed account of this site is now available. No projectile points have been mentioned in the brief notices.

One of the most recent discoveries of a mastodon possibly associated with human artifacts is the Orleton Farms find, from near Plumwood, Madison County, Ohio, excavated in November and December, 1949, by the Ohio State Museum (Thomas 1952). The animal lay in a former pond, imbedded in a gray clay marl and extending into an overlying black muck. The uppermost parts of the skeleton extended within 16 inches of present land surface. At a depth of 14 inches from the surface and 5 inches from the distal end of the femur a stemmed projectile point was found (Fig. 5 *i*), pointing down and with the tip broken off (personal communication from Robert S. Goslin, who excavated the animal). A few other animal bones were also discovered. Some very small bones could not be saved, but 2 deer bones and the claw of a large bird of prey were preserved. Just how these bones came to be included within the same deposit as the mastodon is not known. Human agency for such deposition does not seem completely unlikely but natural causes may explain this situation.

Summary of Finds. This review of the physical evidence for the contemporaneity of man and the mastodon shows the tenuous nature of this association in most cases. These finds cover a wide geographic area and likely encompass a large time span. Some of the western finds such as Potter Creek Cave appear to have quite an early temporal position, while many of those in the east appear to date much later. One impression that does emerge from these data is the basic comparability of the 9 projectile points found with or near mastodons in the east (see Fig. 5). The Island 35 point, the 2 complete ones from the Bourbeuse Creek site, and the only one now known to exist from the Pomme de Terre find are remarkably similar, with a rather broad blade and a straight or slightly expanding stem. The Orleton Farms point is more lineal with a contracting stem. The two from the Richmond mastodon are corner notched points with an expanding convex base. While this is a form quite similar to later Hopewellian types and even to Basketmaker types, as Harrington (1933: 180) pointed out some time ago, it is also found in earlier deposits such as in the 21- to 25-foot levels at the Modoc shelter (Fowler and Winters 1956, Fig. 14), in Levels 5 and 6 at Graham Cave (Logan 1950, Plate 6 *L*), and in the lower levels at Russel Cave (Miller 1956: 548). Thus its presence is not as anachronistic as it might seem at first.

The Buckner Site, Bee County, Texas, projectile points present a problem in the possible mixture of types thought to be separated in time (Sellards 1952: 142). For this reason they have not been considered at length. This site does, however, suggest the contemporaneity of man and the mastodon and also, but less certainly, of fluted and Scottsbluff points with side notched types.

All the eastern points fall within the category of Archaic types and show no greater range in form than one finds on many sites in the area, and points of this kind have been widely illustrated in the literature. They are not very distinctive in appearance and perhaps for this reason have not received much attention from students of early man.

Chronology

Mastodons. The time of extinction in America of the large Pleistocene mammals such as the mastodon and the mammoth has intrigued scholars, paleontologists, and amateurs for a long time. Thomas Jefferson became very involved in the question and helped to foster the belief that these large animals, whose bones he collected, had not been gone from the continent for a very long time. This notion gave way under the geological and paleontological evidence that was accumulating, and by the turn of the century they were once again pushed far back into the fossil past. The Folsom finds in the late 1920's established once and for all the coexistence of man with extinct animals on

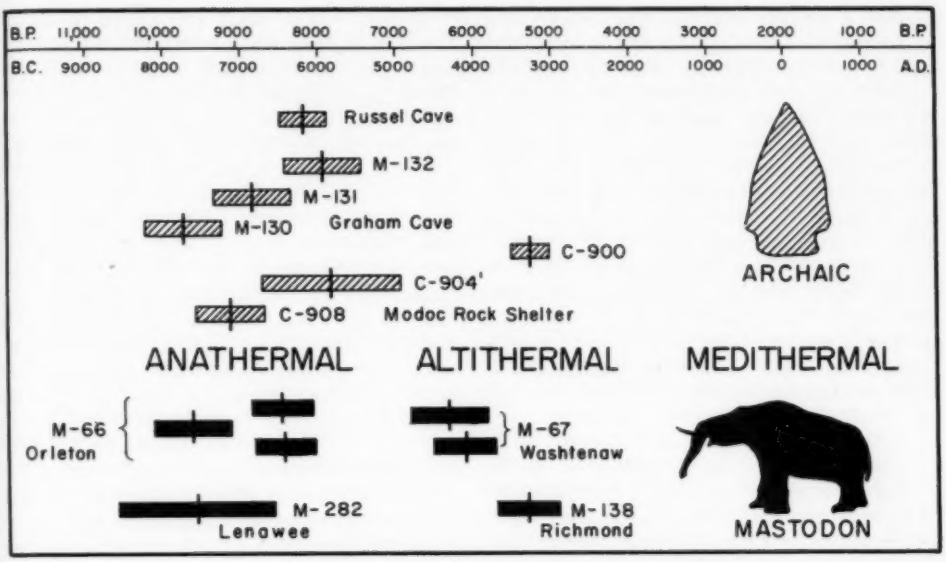

FIG. 6. Radiocarbon determinations for mastodons and Archaic sites in the eastern United States. (See text for sources.)

this continent, and as other finds began to come to light, such as Gypsum Cave (Harrington 1933), the modern paleontologist began to write about the situation (Romer 1933).

At this very moment certain anthropologists proposed a return to the older theme and suggested that the mammoth might have lasted late enough to be remembered in native American Indian myths (Strong 1934; Speck 1935); and later the mastodon was also included (Montagu 1944). This view of the late occurence of the mastodon received further sanction from the noted paleontologist, William B. Scott (1937: 177-9, 260-1, 281), who went so far as to say that they probably survived until historic times. Colbert (1942) took a somewhat more moderate position, for while indicating a survival into the Recent period for these animals, he said that the extinction took place shortly after the arrival of man in the New World in what is *geologically* speaking a yesterday. Loren Eiseley (1945a, 1945b, 1946) met the suggestion of very late survival with vigor and showed that there was little reason to put credence in the Indian myths as facts to support this belief. He also showed that there was no physical evidence now available to indicate that either the mammoth or the mastodon had survived until very recently *historically* speaking. Macgowan (1950), Gross (1951), Sellards (1952), and Romer and Colbert (personal communications) are all agreed that the mastodon became extinct some thousands of years ago, and this view seems to be the general concensus of workers in this field today.

Any discussion of Postglacial extinction always seems to bring up the problem of man's role in this matter. Some paleontologists have pointed up the coincidence of the arrival of man in the New World and the demise of the large Pleistocene mammals shortly thereafter (Colbert 1942: 27). However, Eiseley (1943) concluded that man did not have any major part in their extinction; actually a combination of changing environment, of man upsetting an ecological balance, and possibly even of evolutionary factors may have been involved in this mass destruction of the large mammalian forms.

Just how long ago the mastodon did become extinct is a question to which some tentative answers may be given with the aid of radiocarbon dates. The oldest date so far obtained which may have a bearing on this problem is from a mammoth tusk from Sandia Cave (Hibben 1955; Crane 1955). This determination of over 20,000 years would seem to date the mastodon and cultural materials found in the same layer, although Crane (1955) suggests as an

outside possibility that the tusk might have been obtained as a fossil by the Indians, thus making the mammoth of that age, but not dating the level in which it was found. [EDITOR'S NOTE: In this connection see "Notes and News," this issue.]

The Richmond mastodon has been given a date of 3344 B.C.±400 years (Crane 1956: 667, sample M-138) which corresponds surprisingly well with Sanford's guess date of 5000 to 6000 years (Sanford 1935: 156). This date was obtained from charcoal associated with the mastodon which was described above. However, another age determination on this sample, giving a date nearly twice this age, has not as yet been published (James B. Griffin, personal communication). Another determination on a mastodon tusk from Washtenaw County, Michigan, gave 2 dates: 4144 B.C.±400 years by the carbon black method and 4344 B.C.±500 years by the carbon dioxide method (Crane 1956: 667, sample M-67). Still another date pertaining to mastodons in Michigan was obtained from wood immediately above a mastodon tusk found in Lenawee County, Michigan, and determined as 7612 B.C.±1000 years (Crane 1956: 668, sample M-282).

The Orleton Farms mastodon has likewise been dated by the Michigan counter with wood from underneath the skeleton and this yielded the following dates: 6464 B.C.±400 years and 6504 B.C.±400 years, both by the carbon black method, and 7644 B.C.±500 years by the carbon dioxide method (Crane 1956: 666, sample M-66.)

The age of the Melbourne Interval in Florida also has a bearing on the date of mastodons, whether or not the formation contains artifacts and human skeletal remains. Rouse (1952), using data derived from sea level changes and radiocarbon dates, felt that the fauna in the Melbourne Formation became extinct about 6000 years ago. He noted that this would require a later survival for some of these forms than is generally accepted, but now with more radiocarbon dates available this date for the extinction of the large Pleistocene forms in Florida during the Anathermal and early Altithermal falls in line with other evidence presented in this paper. Thus we have the mastodon in the Eastern Woodlands variously dated roughly between 8000 and 4000 B.C. in the period just preceeding the Altithermal.

Archaic in the East. The dating of several Archaic sites in the East at about this same time range of from 6000 to 10,000 years ago seems to strengthen the case for some of the associations described above. The sites in question are the Modoc Rock Shelter, Randolph County, Illinois (Fowler and Winters 1956) with dates ranging from 8000 to 4000 B.C.; Graham Cave, Montgomery County, Missouri (Logan 1950) with dates of 7744 B.C.±500 years, 6874 B.C.±500 years, and 5944 B.C.±500 years (Crane 1956: 666-7, samples M-130, 131, 132); and Russel Cave, Jackson County, Alabama with a date of 6204 B.C.±300 years (Miller 1956: 542). These dates would seem to indicate that Archaic cultures did indeed preceed the Altithermal period which began roughly 5500 to 4500 B.C. This suggestion will not be accepted too easily by some archaeologists but the western examples of Danger Cave and possibly Gypsum Cave would tend to indicate the use of stemmed projectile points of general Archaic style in the Anathermal period there too.

The evidence from the radiocarbon dates indicates an overlap of Archaic cultures with the existence of at least one of the now extinct Pleistocene mammals, the mastodon (Fig. 6). A question immediately raised by this overlap is why extinct faunal remains are not found in the eastern Archaic sites just ennumerated; instead all have recent fauna. Of the 3 sites, Modoc is the only one in which the faunal remains have been reported on in any detail (Fowler and Winters 1956: 47-53), and no extinct fauna save the recently exterminated passenger pigeon was recognized. However, without elaborating on causes, the excavators do suggest that the bottom levels of the site were inhabited at a time when some extinct forms still persisted despite the lack of their bones in the deposit. This suggestion was made on the grounds of the radiocarbon dates obtained for those levels and on the basis of climatological evidence as well (Fowler and Winters 1956: 37).

Possible reasons will now be explored for the apparent overlap of Archaic cultures with extinct fauna which is shown by the radiocarbon dates but is not found in the stratigraphic record. One explanation is that the situation is brought about through errors in the dating method, by means of what may be termed the "Hunt Effect" (the idea was first proposed, I

believe, by Charles B. Hunt in 1955). He pointed out that many of the dates which have failed to fall in line with the geologic sequence as now generally viewed were those obtained from dry sites such as caves and rock shelters, although it was actually material from similar locations, such as the Egyptian tombs, that checked best with the known historic chronology during the early testing of the method. On the other hand, Hunt feels that the open sites have given dates which are too young, and he feels that the dry dates are more likely correct, on the basis of several lines of reasoning including abundant paleontological evidence from the Salt Lake area (Hunt 1953). Following this reasoning the Eastern Archaic dates from these sites mentioned above would be correct as they are dry dates, but the mastodon dates all from open sites are younger than their true ages, so no overlap would actually exist.

Another solution, which accepts the radiocarbon dates as being in the right order of magnitude, and tries to explain the overlap of the Archaic cultures with the mastodon, finds the explanation of the presence of only Recent fauna in the eastern sites on a cultural level, with supporting evidence from paleontology. The fauna from these sites so commonly called Recent is only so denoted by default since they do not contain as index fossils the large Pleistocene mammals such as the mastodon. Actually all the smaller mammalian forms were also present in the late Pleistocene, and as Colbert (1942) and Hibbard (1949) have indicated, today's mammalian fauna, with the exception of the now extinct big mammals and a few smaller ones, is completely comparable to that of the Pleistocene; it is, as Hibbard (1949: 1419) put it, "post-American-Mastodon" fauna. Thus given the inclusion of a single mastodon bone these same deposits could be termed Late Pleistocene.

How then does one account for the absence of the large extinct fauna in these deposits? The 3 sites were habitation sites and the excavated material represents mainly cultural midden rather than fossiliferous bone beds laid down by nonhuman agency such as was presumably the case at Potter Creek Cave and Friesenhahn Cavern. All that is required to explain the absence is either that the Archaic people did not hunt these animals or else that they killed and butchered the mastodons and similar large animals without bringing back any bones to the campsite with the meat that they acquired. Lest this explanation seem especially contrived to fit the facts as we know them, one must evaluate some of the basic postulates about inferences from midden deposits such as these. First one must realize that the faunal remains at hand reflect neither the total faunal makeup of the region at any one time nor even the total diet of the group involved. Next, the possibility that such large beasts could have been hunted by these people without showing up in the midden deposits is a fact which can be easily corroborated by reference to other archaeological situations both here and abroad and to modern ethnographic data from Africa. Thus it is not too strange that we find no mastodon bones in the cave sites, and the case for separate kill sites, which some of the finds above seem to indicate, is strengthened.

Actually we know little of butchering techniques and procedures for this period. Haury (1953: 3) suggested that the missing parts of the Naco mammoth skeleton might be attributed to removal by human agency, but also suggested that erosion could have been the force at work. Other mammoths in definite kill situations (Sellards 1952) have been found substantially as articulated skeletons, which vitiates the force of Gross's (1951: 104) argument that the Koch finds could not be primary kill sites since they were both relatively whole skeletons. The bones of the Richmond mastodon were quite widely distributed although parts remained articulated (Sanford 1935). Gross (1951: 110-2) indicates that he feels that the animal came to its final position after falling off pond ice that had melted in the spring, but admitted that human agency might be invoked for at least the charcoal that was found and subsequently dated. The Orleton Farms mastodon was oddly broken up and disturbed, and Thomas (1952) explained the broken bones as caused by the dead animal having been trampled by other mastodons. Oddly enough some of the bones of the feet of this and the Richmond mastodon were practically all that remained in close articulation. Nothing in the evidence from either of these finds precluded their meeting their death at the hand of man, and a similar statement can be made with somewhat less certainty for the Island 35 find and the 2 Missouri mastodons of Koch.

Conclusions

There exists in North America a number of probable associations of man and the mastodon. The Island 35 find is one such site, and may be added to the Missouri finds in Gasconade and Benton Counties made by Koch, the Richmond mastodon, and to the recent Orleton Farms discovery in Ohio. The evidence from these sites makes it possible to suggest that Indians of the Archaic tradition using stemmed projectile points encountered and killed mastodons. The date of extinction of the mastodon appears to fall at about 5000 B.C., near the beginning of the Altithermal period, and no good evidence exists to show that either the mastodon or the mammoth survived into more recent times. On the basis of radiocarbon evidence from 3 sites in the eastern United States, it appears that some Archaic cultures also preceeded the Altithermal despite the lack of extinct fauna in middens from any one of those 3 sites. Thus we should be on the alert for more mastodon kill sites, since such skeletons do turn up quite frequently in the east, and we should not be too surprised if we find a stemmed projectile point lodged between the ribs. Fluted points need not have been the only effective dart or spear points used against the large now extinct mammals.

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CLIMATE CHANGE AND CULTURE HISTORY IN THE GRAND CANYON REGION

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IN order to appreciate a given culture or phase of culture at one point in time it is important to have a knowledge of the possibilities that are open to its bearers through the environment. An awareness of the environment and its changes is even more important in order to understand the dynamics of the culture history of any area. It is with this objective, a more complete knowledge of the climate of a particular region with an attempt at understanding its culture history, that this paper has been written.*

The region under consideration, the Coconino Plateau (Fig. 1), lies in the southwestern corner of the Colorado Plateau, immediately south of the Grand Canyon. This area was occupied prehistorically by the Cohonina (Colton 1939: 25-9), and historically by a continuation of this group, the Havasupai (Schwartz 1955). The Coconino Plateau is located west of the Little Colorado River and south of the Grand Canyon. It is roughly delimited by the San Francisco Peaks on the southwest, by Highway 66 on the south, and by the Aubry Cliffs on the west. This plateau is nearly coextensive with the drainage of Cataract Creek, which empties into the Colorado River in the recesses of the Grand Canyon. This 3600 square mile tract is semiarid country with a dominant pinyon-juniper growth, although as one descends into the depths of the Grand Canyon the vegetation becomes increasingly that of the desert.

Climatic Reconstruction. In the Southwest 2 major techniques have been developed which can be used in the reconstruction of prehistoric climate and its fluctuations on the Coconino Plateau, dendrochronology and geomorphology. Even though no extensive work of either kind has been done in the immediate area, it can be assumed that this southwestern corner of the Colorado Plateau has been influenced by, and has reacted similarly to, those factors which have affected climate change in the Colorado Plateau generally. The demonstration of this assumption will derive not from the judgment of the archaeologist but from the detailed examination of the area by experts in the field of climate change.

Some evidence in favor of the hypothesis that the Coconino Plateau has been influenced in the same way as the whole southern Colorado Plateau, at least in some climatic aspects, is already available. Ferguson and Black (1952: 17) have shown a high degree of cross dating between treering specimens from the north rim of the Grand Canyon and the Tsegi and Bryce regions. Although there are recognizable physi-

* I would like to thank Arthur Lange, William Bittle, John Hack, Erik Reed, and Charlie Steen for reading this paper and making a number of valuable suggestions.

ographic differences between the north and south rims of the Grand Canyon, these appear to be mainly a function of the altitude. On the whole, both rims and their adjacent plateaus, each occupying the same peripheral position in relation to the Colorado Plateau, are probably influenced by the same climatic factors. This assumption, although not proven, appears to have enough basis in fact to be used as a working hypothesis in the development of a climatic reconstruction.

Geomorphology. Gregory (1917), Bryan (1941), Hack (1942, 1945), and others have proposed, at least for the northern Southwest, a number of periods of deposition and erosion which reflect possible changes in the climate of the last few millennia. This paper will deal with data on climate only for the last 2000 years.

The development of the geomorphologists' position stems from the historic observations of the Spanish, who noted upon arriving in parts of the Southwest that there were grassy meadows, green valleys, and clear running streams. This contrasts with what is frequently found today in the dry, brown, gully-cut Southwest. The explanation was given that since the balance between erosion and the protective cover of vegetation in the Southwest is very delicate, any change which adversely affects the vegetation will greatly increase erosion. This relationship was postulated when it was noted that where the vegetation thins and bare patches appear, these areas gradually widen and grass becomes too sparse to soak up the rain. The Southwestern variety of rain, which is seasonal and concentrated in heavy summer showers, is extremely destructive. Therefore, with little vegetation to absorb rain drainage, channels are cut and rapidly grow to great size. As the channels deepen the ground water of the area is lowered, permitting even less vegetation to

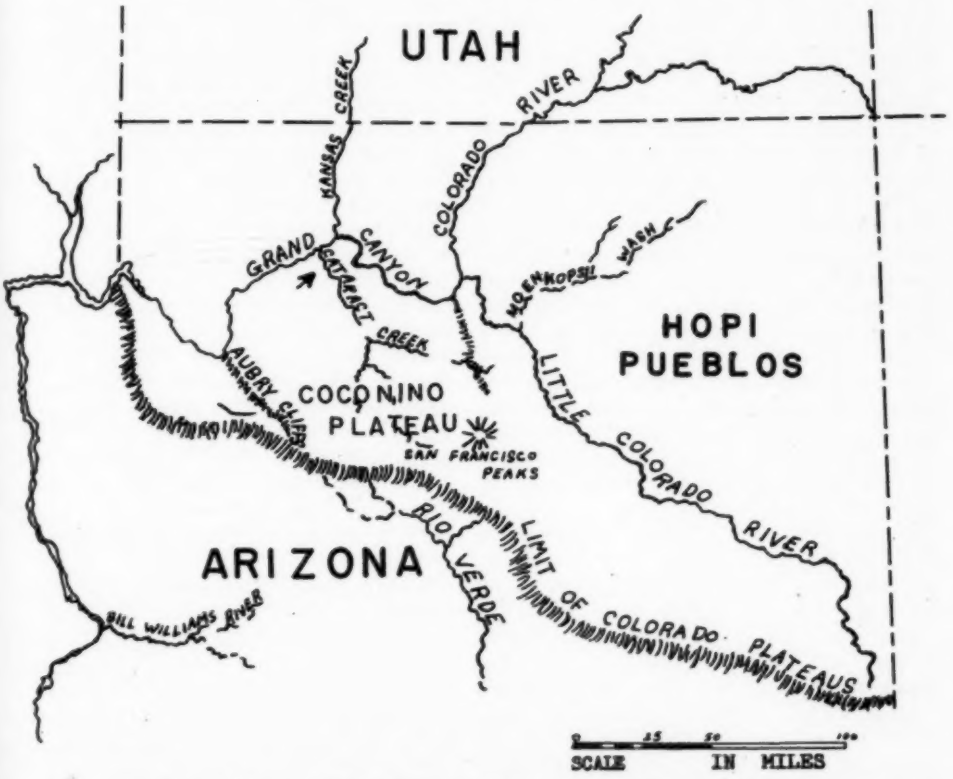

FIG. 1. General location map, with arrow showing location of Havasupai Indian village.

grow. The deepening and widening of channels is thus reinforced (Bryan 1941).

Bryan (1941) reviews the possible causes for the periodic erosion cycles and arrives at climatic change, in some form, as the most likely. This change involves, in all probability, either a decrease in rainfall or an alteration of its seasonal distribution.

An examination of the valleys in the San Juan country (see Hack 1945 for an example of the method used) reveals that the type of erosion taking place in the Southwest today has occurred at least 3 times before. In the Jeddito Valley Hack (1942: 54) found 3 primary deposits of alluvium. On geological and archaeological evidence these were dated as follows: the Jeddito formation, the oldest found, was deposited some time prior to 4000 B.C.; the Tsegi formation was laid down between 3000 B.C. and A.D. 1200; and the Naha formation was deposited between approximately A.D. 1300 and 1700. Between the deposition of each formation an epicycle of erosion occurred. The erosion of the Tsegi formation probably took place between 1200 and 1300, and the post-Naha erosion occurred in the late 19th century, after a long period of stability.

The significance of these alternate periods of deposition and erosion, for the culture history of the Coconino Plateau, lies in their reflection of the climatic conditions at the time of their occurrence. A projection back in time of the contemporary situation would indicate that during the periods of erosion the valley bottoms were green, with the possibility of flood-water farming or direct irrigation. During and as a result of the erosion cycles, however, the water table would have been lowered, the succulent grasses and weeds would have been destroyed, and only an impoverished vegetation could survive. The valley bottoms would be unusable for farming because of the deep arroyos which drained the runoff from the valley.

In summary, during periods of alluviation or deposition water was plentiful while the periods of erosion were characterized by dryness. Combining this information with the dates of the various formations, Hack (1945) has postulated for the Tsegi conditions excellent for farming during the Basketmaker era and continuing through Pueblo II times. Sometime during Pueblo III, however, the post-Tsegi epicycle of erosion occurred and destroyed farmlands, leaving most of the Tsegi area barren. Not until after 1300 or perhaps 1400 did the Naha period of deposition begin, and conditions begin to approach the previous environment.

Dendrochronology. The study of treerings has also played a major part in the reconstruction of climate in the prehistoric Southwest. The results of this work were invoked early in the explanation of prehistoric events. For example, the Great Drought of the late 13th century, revealed by the dendrochronologists, was until recently considered the most serious cause of the abandonment of the San Juan area. Many alternative explanations have recently been expounded however, including the arroyo cutting hypothesis. On the other hand, what seems of more importance is the examination of the Great Drought hypothesis itself. Reed (1944: 67) has pointed out (1) that there is very little correspondence between the drought and abandonment in many areas, and (2) that the bad years of the drought were interspersed with a number of reasonably good years, which probably made it possible for the people to survive. Nevertheless, the Great Drought does stand out as a distinct climatic feature which must be considered, whether it is invoked as a cause for a cultural event or not. It has recently been noted (Schulman 1954: 26) that the Great Drought may only have been "... the final phase of a drought, of sometimes phenomenal intensity, from A.D. 1215 to 1299...."

Schulman (1938: 211) has postulated the existence of other especially severe droughts, lasting 2 or 3 decades. These took place near A.D. 715, 1100, and 1585. He also noted the existence, from the treering record, of stormy periods after each drought. Because of indications of gradual retreat of the yellow pine forests and several other changes in floral and faunal distribution, Reed (1944: 68-9) has suggested a long term trend of increasing aridity in the Southwest. He feels that this was, or might have been, important enough to cause or affect a number of major cultural-historical events.

Climatic Periods. In summary, the San Juan drainage, and by extension the Coconino Plateau, seems to have been climatologically influenced by at least 3 sets of changes which are recognizable from the past and present environmental record. These are (1) 3 periods of erosion and deposition, (2) a series of droughts with ensuing stormy periods, and, much less definite, (3) a long term gradual increase in

aridity. With this information a hypothetical climatic history of the Cataract Creek drainage area, that is, the Coconino Plateau, can be attempted.

For the purpose of this paper 3 climatic periods will be considered. These generally coincide in time with the periods of erosion and deposition in the San Juan drainage area.

Period I	pre-1 A.D.	to	A.D. 1200
Period II	1200	to	1350
Period III	1350	to	1700

The delimiting dates for these periods are to be considered as arbitrary divisions of gradual changes.

Period I was probably characterized by fairly moist conditions and even though the waterways of the Coconino Plateau were not constantly flowing, the more abundant rainfall was sufficient to give the Plateau a much more lush growth than is found today. Whereas much of the present-day country is covered either with short grass plains or a pinyon-juniper growth with short grass undercover, the distribution of the ponderosa pine and its associated flora must have been wider in this early period.

A spring in lower Cataract Creek Canyon, which today waters the Havasupai Indian reservation (Fig. 1), is supposedly fed by underground drainage from the San Francisco Peaks. If the greater moisture during this first climatic period was also reflected at the Peaks, then the canyon itself may not have been inhabitable because of the amount of water that constantly flooded the valley. On the other hand, the stream, without inundating the canyon to an unusable degree, may have nourished an extremely heavy growth, difficult to keep clear. If the plateau was receiving enough moisture, the canyon might not have offered any advantages to the early farmers who lived during this time.

Two bad droughts apparently occurred during Period I, the first near A.D. 715 and the second near A.D. 1100; both supposedly were followed by stormy periods. If there has been a gradual decrease in the moisture, then this period would have had more moisture in all forms than any of the succeeding ones. Therefore, Period I was undoubtedly an excellent time for farming on the plateau, even considering the 2 droughts. It may, however, have been too moist for intensive occupation of lower Cataract Canyon except during the last few hundred years. This period may, however, have offered good opportunities on the lower benches of the Grand Canyon itself.

Period II, lasting from A.D. 1200 to 1350, was short compared to the preceding one but could have had a profound effect on the prehistoric people living in the area. The erosion cycle, which characterizes this period, may have been triggered by the stormy period following the drought of 1100, it may not have begun with the 13th century drought, or it may have had an origin independent of either of these. This period was probably marked on the plateau by a decrease in the vegetative cover and a lessening of farming possibilities. The traditional great drought of the late 13th century took place during this period and could have been the trigger or the multiplier of the degradation caused by the erosion. How this period affected the lower canyon of Cataract Creek is difficult to say. Hack (1942: 79-80) has shown how the windblown sand of the Hopi country inhibited the formation of arroyos, thus allowing continuous occupation of the area during and after the abandonment of the surrounding regions. The Supai formation in the lower canyon erodes into a sandy, red dust, and throughout the year, especially during the wind storms of the spring, this dust is frequently in the air in great quantities. It could well have prevented the cutting of a deep arroyo in the canyon during Period II. Another factor possibly affecting the lower canyon is the depth of the valley deposition itself. At present the creek flows on bedrock with a slight grade of alluvium away from it to the towering cliff walls on either side. In the one level section of the lower canyon, watered by Cataract Creek, today almost all land is used by the Havasupai for irrigation farming. At the present time, during a period of erosion, the creek has apparently cut down in most places as far as is possible, yet irrigation is still practiced with little difficulty. Therefore, the decrease in moisture over the whole region, which may have had a detrimental effect on the plateau, could have increased the possibilities of farming in the lower canyon by cutting down on the density of the growth as well as on the water supply which previously might have been of such quantity as to be unmanageable.

The lower benches of the Grand Canyon were probably not inhabited by farmers at all

during this period. Today these areas are extremely dry and of little use in farming activities.

Period III is again characterized by deposition in the arroyos and the drainage channels in general. The fact that this period was so much shorter than the previous depositional one, Period I, may indicate that the gradual long term drying process was taking effect. Again, farming may have been possible on the plateau, at least the floodwater variety (Bryan: 1929). The increased over-all dryness, coupled with the fact that the lower canyon of Cataract Creek was probably already under control, doubtless made continued plateau farming likely.

The effect of this period's climate on the lower benches of the Grand Canyon is an interesting point for speculation. Historically, certain of these places were farmed, and the probable increase in moisture, with a greater spring flow, may have again opened these areas for limited cultivation. Schulman records only one drought for this time, around A.D. 1585. Coming as it did during such a long period of prosperity, it undoubtedly had little long term effect on the people.

Cultural Changes. In as much as the major purpose of this paper is to outline a hypothetical climatic sequence for the Grand Canyon region, no attempt will be made to describe in detail the archaeological sequence of the area; this has been dealt with elsewhere (Schwartz 1955). However, a short culture-historical description should illustrate how the postulated climatic changes were influential in the development of the regions culture. It must be stressed that no attempt will be made here to review the other possible factors affecting the growth and change of culture in northwestern Arizona, although some were certainly more important than the environmental changes. The objective of this section is merely to illustrate some of the relationships between the cultural and climatic changes.

From the archaeological evidence available, it appears as if the prehistoric predecessors of the historic inhabitants, the Havasupai, entered the region about A.D. 600. Once an initial period of adjustment to the new environment had taken place the population density began to rapidly increase, tripling by A.D. 800 and doubling again by 900. The entire Coconino plateau was, by the 10th century, occupied by these prehistoric Havasupai, probably practicing a floodplain type of farming. This was possible at this time (Climatic Period I) because of the relatively great amount of moisture and conditions generally conducive to farming.

By the beginning of the 10th century the population had reached its saturation point in relation to the available land on the plateau and the traditional techniques of farming. For the next 200 years the Havasupai experienced a population climax and, with this, a period of experimentation in both architecture and agriculture. Not only were new building styles introduced, but new farming areas, such as canyon bottoms, were for the first time utilized.

In the years following A.D. 1100 this northwestern section of northern Arizona experienced tremendous population movements. All of the Coconino Plateau occupants moved into Cataract Creek Canyon, where the farming techniques developed by the handful of inhabitants who had lived there since about 900, when the plateau area was beginning to feel population pressure, were now used to support the whole tribe as well as certain foreign immigrants. The beginning of this population movement does not coincide exactly with the date set for the start of Climatic Period II, but it is interesting to note that by 1200, the postulated beginning of Period II, the plateau was completely abandoned. The next 150 years of canyon occupation, during the whole of Period II, was one of defense, with the construction of cliff structures and the abandonment of valley floor habitations. During this period of enforced canyon life the summer farming was perhaps supplemented in winter by plateau gathering and hunting, and it was at this time that the pattern of future Havasupai economic life was set. By 1350 when it was possible once more for the Havasupai to move back on the plateau, as evidenced by the abandonment of the canyon cliff dwellings and the reestablishment of valley floor dwellings, it was no longer possible to farm the ancestral upland. For even with the increased moisture of Period III the general increase in aridity had made the plateau a much less favorable area for agriculture, certainly less so than the canyon. At the time of contact, the Havasupai were found to be farming almost exclusively in their canyon home, while using the plateau only in the winter for gathering and hunting.

There thus appears to be a quite interesting relationship between the climatic changes and the cultural development in the Grand Canyon region. During the first climatic period plateau agriculture was practiced very widely and was successful enough to foster tremendous population growth in northwestern Arizona. The second climatic period on the other hand correlates with a cultural period of population decline on the plateau and defense in the canyon; the complex relationship of these factors deserve more detailed treatment than can be given them in this paper. The third climatic period coincides with a peaceful period of farming, but in the canyon rather than on the plateau, where agriculture was much less practical than it had been previously.

Summary. This paper attempts to reconstruct in outline the climate of the Coconino Plateau and adjacent Grand Canyon from A.D. 1 to 1700 with the use of various kinds of evidence, as well as to show something of the relationship between these climatic changes and the archaeological sequence. It is concluded that 3 basic periods of climate stand out, the first and third characterized by fairly moist conditions and the second by a relatively dry condition. Superimposed on these periods was a postulated over-all increase in aridity and scattered throughout the sequence were a number of droughts and stormy periods. With this information we are in a more advantageous position to evaluate the cultural changes which took place in this area prehistorically, and from this should come a more thorough understanding of the culture of its ancient and modern inhabitants.

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AN ANTHROPOLOGICAL RECONNAISSANCE OF BIMINI, BAHAMAS

JULIAN GRANBERRY

UNDER the auspices of the University of Florida Anthropology Laboratory the writer devoted the second and third weeks of June, 1955, to a survey of the Bimini Islands, Bahamas, the primary objective being an archaeological site reconnaissance of the group. Although archaeological findings were few, there were significant features meriting the observations presented in this report.

One of the most perplexing problems of the anthropologist in the Caribbean is the origin of preceramic, pre-Arawak peoples and culture complexes. Archaeologically these occur from Western Cuba south through the Virgin Islands, and then again, moving northward into the islands from South America, in Trinidad. Preceramic sites have not been reported from islands in the break between St. Thomas, V.I., and Trinidad. In Trinidad the San Juan, Tortuga, St. John, Ortoire, and Cocal sites, all preceramic, have been discussed but not yet fully defined (Rouse 1953: 94, 108). Presumably they represent a tradition from the South American mainland.

The northern preceramic complexes have been grouped together under the generic term Ciboney (Rouse 1948: 497-501) because of similarities in site types, artifact types, and, presumably, nonmaterial aspects of culture. Under the designation Ciboney, Rouse (1951: 251, Fig. 2) includes Cayo Redondo and Guayabo Blanco (Cuba), Cabaret and Couri (Haiti), the Railroad Cave site (Dominican Republic), the Coroso sites (Puerto Rico), and the Krum Bay site on St. Thomas (Virgin Islands). The last three, however, are questionable. In both Trinidad and the Greater Antilles preceramic strata always lie beneath ceramic strata in sites with both occupations, and it has therefore been assumed that preceramic complexes represent first settlement in the West Indies (Rouse 1951: 250; 1953: 96). In the Greater Antilles Ciboney groups must have been fairly widespread, judging from archaeological remains, but by historic times they had been restricted by Arawak pressure to Western Cuba and the Guaicayarima Peninsula in southwest Haiti (Rouse 1948: 497).

Cosculluela (1922: 9) and Rouse (1949) have suggested a North American origin for the Ciboney, specifically a Floridian origin, but other archaeologists have assumed a South American homeland (Harrington 1921, Vol. 2: 424-6; Herrera Fritot 1943: 268). While the gap in preceramic sites between the Virgin Islands and Trinidad affords very little evidence to uphold the latter theory, we have, on the other hand, as little evidence to propose a North American background for these people and their culture. It is true that the Lesser Antilles gap may in actuality represent nothing more than inadequate archaeological knowledge of the region, but for the present we must assume that preceramic sites do not occur there. The data we have today on the early nonceramic phases of the Archaic tradition in Florida show more points of correspondence with Ciboney than can be found between Ciboney and South American nonceramic cultures (Rouse 1949).

This problem of Ciboney origins led the writer to work on Bahamian archaeology in 1950. The archipelago, providing excellent stepping-stones south, held a nebulous position in Caribbean archaeology, and it seemed probable that preceramic sites would be found there if the Ciboney had migrated to the Greater Antilles from Florida. With this problem foremost in mind all accessible archaeological material from the Bahamas was examined, and a thorough analysis was made of the surveys of Brooks, De Booy, Rainey, Herbert Krieger, and Goggin. The writings of Las Casas, Anghiera, Oviedo, and Herrera y Tordesillas were carefully read for references to the islands. No definite preceramic sites were noted, and there were few indications of any pre-Arawak occupation of the Bahamas. It is true that Strombus gouges reminiscent of the Ciboney *gubia* were found from both extremes of the archipelago and that undeformed, characteristically Ciboney, crania have been reported from Andros, but this evidence is so tenuous that no clear-cut decision can be based upon it. A report of Ciboney middens from the Berry Islands and Andros (Krieger 1937: 98) has not been verified nor further described.

With the completion of the general survey (Granberry 1955) the writer concentrated his attention on further clarification of the specific problem. Although most of the archipelago had been surveyed for sites, the western end of Grand Bahama, Great Isaac Cay, the Biminis, the Cat Cays, the islets down to Orange Cay, and Cay Sal and the neighboring Anguila Isles had not been touched upon, except for De Booy's brief stop at Bimini in 1912 (De Booy 1913). These islands form an arc between the southeast Florida coast and Cuba and are the first land encountered after crossing the Gulf Stream. It would seem logical to suspect that Ciboney groups would stop somewhere along this arc in their southward journey, which must have been a haphazard and long-term migration. Somewhere within this arc preceramic sites might occur. The Biminis are closer to Florida than any of the other groups on the arc and they were therefore selected as the departure point of investigation.

There are 2 major islands, North and South Bimini, as well as several smaller ones to the immediate east of Alice Town on the south end of North Bimini. South Bimini, which is relatively flat, is not settled heavily and is covered with mangrove forests. North Bimini, too, is

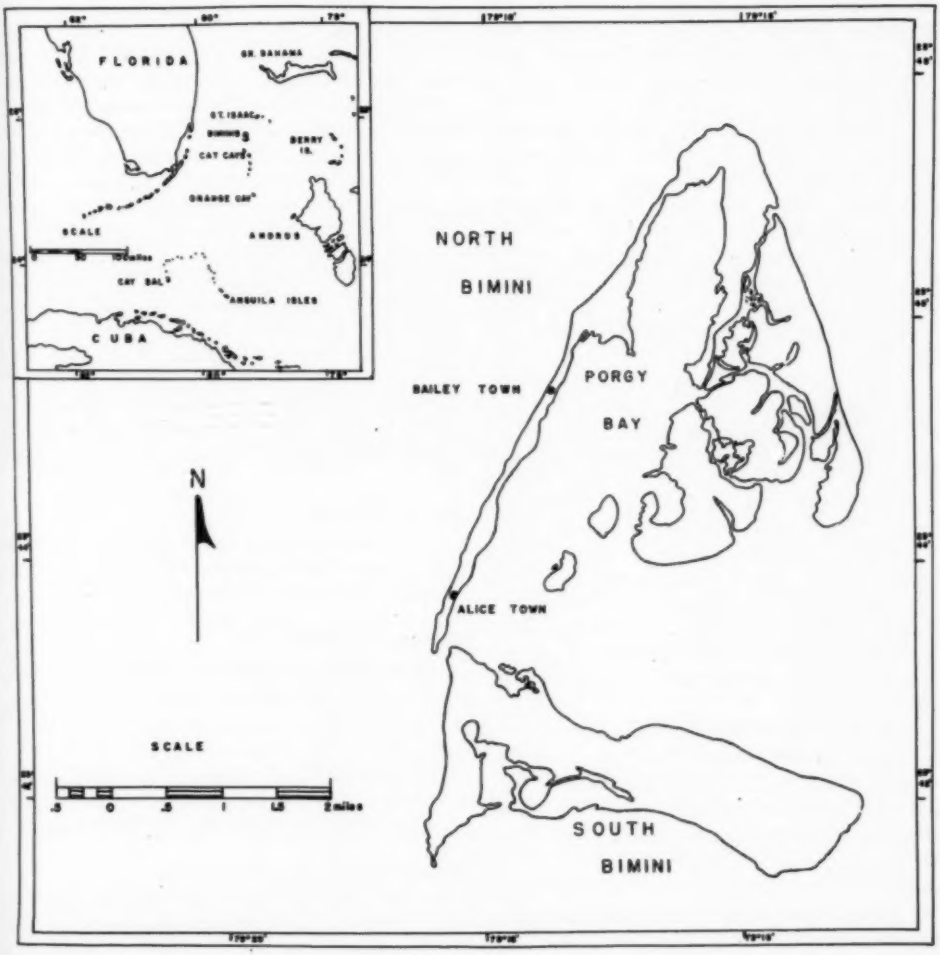

FIG. 1. Map of Bimini, Bahamas.

flat and mangrove covered, except for a narrow strip of land about 4 miles in length and rarely exceeding ¼ mile in width, extending southwards from the west end of the island near Porgy Bay to within a few hundred yards of South Bimini. This spit of land has a ridge down the center averaging 15 to 25 feet above high-tide level. It is tolerably well protected on the bay side from all but the most severe storms by the shallow water of the Grand Bahama Bank, the eastern extension of North Bimini, the protecting arm of South Bimini, and the bar between the north and south islands. There is a narrow beach on the ocean side, from which the underwater shelf slopes down rapidly within a few miles to the great depths of the Gulf Stream. The central ridge juts into the beach with steep limestone overhangs and small cliffs, which, unlike those on most other islands in the Bahamas, are not pitted with caves. The ridge soil has not eroded away to any appreciable extent, and, although sandy, can support the cultivation of vegetables and basic garden produce. Coconut groves cover a considerable portion of the cultivable area. The temperature is usually high, but it is always bearable because of constant east winds. Rainfall, bringing the only water supply, is frequent during the summer and early fall months.

A thorough survey of the ridge area of North Bimini, the only section well suited to and high enough for permanent habitation, revealed no signs of sites, although the bay front at low tide is covered for extensive stretches with English ceramics dating generally from the 1800's and 1900's. The natives, both young and old, knew of no Indian remains. Indeed, most of those questioned stated with certainty that no Indians had ever lived on the island. The older people were not familiar with the term "thunderbolt" or "thunderstone," frequently used in the Bahamas as a name for the Arawak petaloid stone celt.

The only artifacts known from Bimini are a perforated stone pendant and an anthropomorphic coral *zemi* or spirit-image found by De Booy in 1912. Both specimens are now at the Museum of the American Indian, Heye Foundation, and are without doubt of Arawak origin.

If Bimini was inhabited in prehistoric times, village or campsites would certainly have been on the central ridge of North Bimini. The 2 settlements of Alice Town, to the south, converging with Bailey's Town, to the north, cover the entire 4-mile stretch of the ridge with the exception of very infrequent unsettled areas. Any Indian sites were probably destroyed long ago by the establishment of these 2 towns. One report of a burial mound on the south end of North Bimini was received, but this proved to be a cemetery dating from the devastating cholera epidemic of the late 1800's.

From historical evidence we know that the islands in the vicinity of Bimini were at least sparsely inhabited by Arawak as late as 1513 (Herrera y Tordesillas 1936, Vol. 3: 324-5). De Booy's finds indicate that Bimini itself was inhabited by Arawak, but there is no indication of earlier occupation.

The Biminis are not the only islands in this arc, and investigation of others, some still unsettled, is planned for the near future. Although such work may produce further negative results, these should be more satisfactory than the present questionable status of Ciboney origins.

Of ethnological interest was a single report, given the writer by Miss Rita Cartwright of Bimini and New Providence, of the use of *obeah* in the cure of asthma. Miss Cartwright stated that *ouanga* charms, containing a gray powdered mixture, had been used by both whites and Negroes in Nassau and were held in high repute as asthma cures. The "doctor" using this method was said to have been taught by his father, who acquired a knowledge of *obeah* while living in Cuba as a young man.

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PERFORATED ELK TEETH: A FUNCTIONAL AND HISTORICAL ANALYSIS *

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IN 1955 an archaeological field party from the State Historical Society of North Dakota recovered 2 perforated elk teeth from a village site, 32SI4, on the Missouri River in North Dakota. The excavations at this site were directed by Alan R. Woolworth and the writer. In an attempt to determine the significance of these specimens the writer searched the literature for data on their distribution in archaeological and ethnographic contexts and hints as to their function among socio-linguistic groups.

The perforated canines of mammals are nearly universal among North American Indian costumes. A large variety of animals have been used for sources of these teeth including bear, canids, horses, bison, and elk. Most of these teeth were suspended point down by a thong passed through a perforation in the root. Northern Plains Indian costumes are commonly decorated with the canines of elk; in fact, the presence of elk teeth in large numbers on garments permits an almost certain identification of a "Plains" item of apparel. Great quantities of these teeth were formerly used in costume embellishment, and today they are not only treasured heirlooms of the Indians yet possessing them, but are highly prized by non-Indian collectors.

Despite the common use of elk teeth on Plains Indian costumes, little has been said of them with respect to function and distribution. The primary sources concerning these pendants are in 19th century accounts of Western travel and exploration. Elk teeth are commonly slighted, and they are only briefly noted in most ethnographic accounts. The perforated elk tooth is an artifact type, defined and classified by the material of origin, the manner of modification, and form. This morphological type is identified, by analogy and association, with pendants on historic Indian costumes and with certain specimens recovered from archaeological sites. Functional interpretations of artifact types may serve as tools in the reconstruction of the culture history of an area. Because elk teeth are found in an integrated and patterned trait complex unique to the Northern Plains and its periphery, these pendants are of interest to those concerned with the history of that area.

Elk teeth are commonly found on the upper parts of a one-piece, sleeveless dress, or on the

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cape of a cape-and-skirt dress. Aboriginally there is little evidence that men wore elk teeth except in necklaces, together with bear claws and other pendants, or alone as good luck charms. The tooth used is the canine of the American or Rocky Mountain Elk, the Wapiti (*Cervus canadensis*). The upper canine is well developed in both sexes, but is more specialized in the male (Murie 1951: 90). The tooth usually observed is the permanent canine, although Hodge (1907: 17) cites the use of milk teeth.

The pendants are perforated at the root biconically through the labial and lingual aspects of the tooth by a tapered drill, and the center of the perforation is reamed out. The root of the tooth is thin and flat, and drilling is more easily accomplished than in the canines of many other mammals, which have thick roots with convex surfaces. Most specimens have a high polish, and a few are lightly incised with simple geometric designs. After the near extermination of the elk in the Northern Plains, elk canines became rare and difficult to obtain, and substitutes were commonly made of bone. The bone substitutes are usually painstakingly carved so that no cancelleous tissue remains. These substitutes are almost indistiguishable from a genuine tooth, and sometimes close inspection is necessary to determine the actual material used.

Elk teeth are common on ethnological specimens from the Northern Plains, but they are absent on the apparel of tribes indigenous to the Central Plains, nor have they been found to date in any Central Plains archaeological site. The occurrence of the teeth on garments collected in this area is restricted to apparel worn by tribes that entered the area in late historic times, the Cheyenne, Arapaho, and Dakota.

Archaeological Occurrences

The archaeological specimens recovered so far are dominantly from sites known to have been occupied, at least in part, by the Mandan, or from early sites which have artifact contents typologically similar to that of the Mandan. Pendants are found in 7 sites in North Dakota.

The State Historical Society of North Dakota found an elk tooth pendant in a large, bell-shaped exterior pit, and another in the fill of a long rectangular house at 32SI4. The pottery at this site, sometimes called the Fort Yates site, appears to be typologically antecedant to that in historic Mandan sites. It is located on the Missouri River in south central North Dakota, and is dated at about 1350 to 1450.

The Fort Abraham Lincoln, or On-a-Slant site (32MO26), the Sperry site (32BL4), and the Boley site (32MO37) in central North Dakota near the town of Bismarck, also yield elk tooth pendants. Each site has trade goods dating it between about 1650 and 1804. Surface collections from these sites, in the State Historical Society Museum in Bismarck contain a few elk tooth pendants.

The Fort Clark village site (32ME2) is a Mandan village abandoned after the decimation of that tribe by smallpox in 1837, and later occupied by the Arikara. Burials exhumed near the site have contained numbers of elk tooth pendants. Like-a-Fishhook village (32ML2) is the last earth lodge village occupied by the Mandan, Hidatsa, and Arikara before they were alloted land in severalty. The site was occupied between 1845 and 1886. Surface finds at the site by local collectors include both elk tooth pendants and bone substitutes. Elk tooth pendants and substitutes are today found in surface burials on the Fort Berthold Reservation, present home of the Mandan, Hidatsa, and Arikara. The graves in which the pendants occur are in a dominantly Mandan and Hidatsa sector of the reservation, and probably date after 1880. A 3 or 4 year old child, buried in a small trunk on the ground surface, was accompanied by nearly 150 elk teeth. Other burials on the reservation contain numbers of these teeth, some of which are stained red or green, probably from wetting and contact with colored cloth. And finally 2 elk teeth were found in sites apparently occupied by the Arikara in the vicinity of Mobridge, South Dakota (Wedel 1955: 180-1, Pl. 62 *i*).

The spatial distribution of archaeological specimens is limited to south central and west central North Dakota along the Missouri River, where they are generally associated with sites occupied by the Mandan. The time span represented by these sites is the 14th to the 20th centuries. The archaeological occurrence of elk tooth pendants is not restricted to the complex associated with the Mandan, however, and it is pertinent to note the distribution of these pendants in other areas where they are associated with a described archaeological complex.

The Whittlesey focus in northeastern Ohio and southeastern Michigan has these pendants. At least one component of the focus seems to

represent the Erie tribe of about 1590 to 1650, although other components may be earlier. The focus is a Late Woodland manifestation showing evidence of a relationship to the Younge focus of eastern Michigan (Quimby 1952: 106). Perforated elk teeth have also been found at the Roebuck site, Ontario, and pendants of this nature occur also in other Iroquoian sites (Wintemberg 1936: 65, Pl. 15, *4*), as well as imitation teeth cut from mollusk shells.

Two perforated elk canine beads are reported from Burial 4 at the Frontenac focus site at Frontenac Island, New York. This focus seems to be derived from the Lamoka focus, and is precedent to the Brewerton focus (Ritchie 1944: 268, Pl. 152, *20-1*). A radiocarbon reading of 4930±260 from charcoal in the deepest refuse levels at the site (Johnson 1951: 7) dates the site at about 3000 B.C.

Since only 2 teeth were found in the Frontenac Island burial, the functional identification of the teeth as beads by Ritchie may be correct. Elk teeth are more numerous in burials at Iroquoian sites, where they appear to have been strung on necklaces. The artifact type from these sites is identical to that from Northern Plains sites, but is not used for the same style of decoration as the pendants from that area, where from 150 to 600 teeth may adorn a single garment. There is no apparent relationship between the Frontenac focus, the Whittlesey focus, the Iroquoian sites, and the complex represented by the Mandan, and it might be inferred that the pendants in the latter complex represent independent invention. Because of the widespread use of perforated canines, an independent utilization of a common decorative element may be illustrated here.

Historic Occurrences

The use of elk tooth pendants on historic Indian costumes is noted for several sociolinguistic groups, and for each we will summarize the earliest recorded date of observation, techniques and patterns of attachment, and the values associated with the pendants.

Mandan-Hidatsa. As early as 1833 Maximilian noted that the Mandan gave a horse for 100 or 150 elk teeth (1906: 289), and sketches by Catlin in 1837 show 2 Mandan women wearing a single row of horizontally placed elk teeth at the level of the bust on dresses (Catlin 1857, Pls. 52-3). An account of the manufacture of artificial elk teeth in the early 20th century by a Mandan on the Fort Berthold Reservation states that they were made from the leg bones of oxen. "This man makes five artificial teeth in a day. He saws out the pieces and works them to shape with file and sandpaper. . ." (Wilson 1924: 235). Maximilian's observation for the Mandan applies also to the Hidatsa. Buffalo-Bird Woman, an Hidatsa, consumed an entire half day describing a dress with 600 elk teeth, evidently taking great pride in its description (Wilson 1924: 235, Fig. 64). Since the Hidatsa have been closely associated with the Mandan through much of their recorded history, it might be suspected that the tribe was aware of the use of elk teeth prior to 1833, when Maximilian observed them using the pendants.

Crow. References to this tribe using elk teeth are common in the literature, and they are said to be making them today. Kurz (Hewitt 1937: 251) suggested that this tribe:

> . . . originated that singular style of trimming, for women doeskin garments, with rows on rows of elk's teeth placed horizontally across front and back.

Denig gives much the same evaluation in 2 references:

> Ten ermine skins will also bring a horse among the Crow Indians, and 100 elk teeth are worth as much, there being but two teeth in each elk which are suitable. . . . The elk are not killed in great numbers by any one hunter, so that much time and bargaining are required for an individual to collect 300, the number usually wrought on a Crow woman's dress (1930: 589).
>
> A frock is not complete unless it has 300 elk teeth, which, with the other shells, skin, etc., could not be bought for less than $200 (1953: 36).

Denig suggests that these dresses were worn on special occasions, but not in everyday life (1953: 34). One such occasion was weddings, when elk tooth dresses were given to the bride (Lowie 1913: 172, 192). Lowie describes an instance in which male clowns wore elk teeth at a dance: "One of the clowns is dressed up as a woman, wearing a fine elk-tooth dress; he is obliged to walk, talk, and sit like a woman, and is stuffed so as to simulate pregnancy." The Crow word for such clowns seems to mean "woman impersonator" (Lowie 1913: 207).

Blackfoot. In 1833 Maximilian stated that Blackfoot "girls are dressed in the same manner as the women, and their dresses are generally ornamented with elks' teeth, for which the Indians pay a high price" (1906: 103-4). This

tribe valued a woman's dress decorated with elk teeth at 2 good horses, expressed as "the best buffalo horse" or "the best horse you have" (Ewers 1955: 220). Wissler describes and illustrates a dress dating from about 1843 with a single horizontal row of elk teeth on the bust (1910: 125-6, Fig. 75). The use of elk tooth pendants in necklaces is suggested by Maximilian when he says, "Some Piekanns hang round their necks . . . the teeth of buffalos, stags, elks, horses, &c . . ." (1906: 100). A Piegan Blackfoot informant of Ewers (1955: 223) stated that some men believed it would bring them luck and good health to wear a necklace of horse or elk teeth.

Dakota. Dresses and capes adorned with elk teeth are documented in the early 20th century for the Hunkpapa, Oglala, and Blackfoot Dakota on the Standing Rock Reservation in North Dakota by photographs taken by Frank B. Fiske, now in the museum of the State Historical Society of North Dakota. An Oglala woman is illustrated (Hodge 1910: 110) wearing an elk tooth dress with 5 horizontal rows of teeth on the dress front, and with horizontal and vertical rows of teeth on the sleeves.

Two Dakota women sketched by Catlin (1857, Pls. 95-6) wear brass buttons in much the same manner as elk teeth were worn. Since brass buttons, cowrie shells, and other circular or oval objects often occur on garments, it appears that the use of elk teeth is only one technique of a wide spread style of ornamentation. Sketches and photographs must be carefully examined before positive identifications of elk teeth are assured.

A Dakota man's pipe bag, decorated with glass beads, has 2 elk tooth pendants attached. This specimen, in the Nebraska State Historical Society Museum in Lincoln, was collected about 1890 on the Rosebud Reservation in southwestern South Dakota.

Assiniboin. Catlin remarks that in his Plate 34 is a fair illustration of the dresses of the women and children, which are usually ornamented with quill work and rows of elk tooth pendants (1857: 57). A contemporary note on the use of elk teeth was made by the writer on the Standing Rock Reservation at the annual Fort Yates Fair on August 28, 1955. A professional Assiniboin dancer, First-to-Fly, from Rocky Boy, Montana, wore a leopard skin vest with several elk teeth or elk tooth substitutes attached. These were worn in the same manner as those on women's dresses, although not as profusely.

Others. Larocque, in a journal reporting his visit to the Rocky Mountains in 1805, reported that elk teeth were used as ornamentation among the Flathead, and that they gave a horse for 70 or 80 of them (1910: 71). Spinden noted the use of elk teeth as decorative elements on women's dresses among the Nez Perce. He comments, however, that the elk teeth on the body of the dress were placed with "no studied care" (1908: 216, 220). Data on Cheyenne utilization of elk teeth are limited, but Dodge (1882: 306, Pl. 3, 9) illustrates a dress attributed to this tribe which he valued at 8 ponies, or $200. A note referring to the inheritance of elk teeth is given for the Arapaho (Hilger 1952: 106-7), and Dorsey (1903: 18) illustrates a Kiowa girl wearing an elk tooth dress with at least 6 horizontal rows of elk teeth on the bodice.

The use of elk teeth for adornment and for use in necklaces is noted for the Bannock, Western and Northern Shoshone, Ute, and the San Juan Paiute. The occurrence of these teeth is noted on culture element distribution lists. Steward (1943: 321, 377) notes the use of the teeth among the Bohogue Shoshone and the Northern Paiute-speaking Bannock at Fort Hall, Utah, the Grouse Creek Shoshone, the Shoshone of Promontory Point and Cache Valley, and the Gosiute of Skull Valley. Among the Bohogue Shoshone at Fort Hall, elk teeth and hooves were placed on women's dresses. The infilteration of Plains elements has been continuous among the Bohogue Shoshone, possibly due to contact with the Nez Perce and Flathead, and the Northern Paiute-speaking Bannock were in close association with the Bohogue Shoshone at Fort Hall (Stewart 1942: 277).

Summary and Conclusions

There is a functionally integrated cluster of traits discernable in the utilization of elk teeth, and this "elk tooth complex" has a place in the values of the socio-linguistic groups in which it occurs. The traits associated with this complex in each of the bearing groups are of 2 classes: descriptive and functional. The descriptive traits are:

1. The tooth used is the canine, which is perforated in the root. Attachment is by means of sewing or suspension by a thong to articles of dress.

2. The pendants are worn in a stylized manner. For women, they encircle the upper portions of a dress or cape in a horizontal line, or in horizontal series.

3. The use of large numbers of teeth on dresses is a strictly feminine mode of decoration. Their use by males is restricted to rare inclusions in necklaces or on such articles as pipe bags.

The functional or behavioral traits associated with the use of these pendants are:

1. The display of the teeth on feminine attire is a means of signifying wealth in a family, since great time and expenditure is necessary to acquire them.

2. Elk tooth dresses are a prestige item, worn or given as gifts on special occasions. Their use among the tribes considered is somewhat analogous to the role of the mink coat in contemporary American culture.

3. For men, the use of these pendants brings good luck and health. They may also be donned when males wish to imitate feminine attire and behavior.

Kurz stated that the Crow originated the use of highly decorated elk tooth dresses, but no other statements in the literature occur concerning their origin. However, the artifact type in the Northern Plains is first noted in Mandan village sites, and it is inferred that the type was independently invented by the Mandan sometime about the 14th century. The antiquity of the use of elk teeth is strengthened by the cultural generalization that a well-defined mode of treatment or style is apt to embody an old cultural element (Sapir 1916: 18). The large area over which elk teeth were used, extending well to the west and southwest, might also imply a moderate antiquity, although rapid diffusion might explain this.

Archaeological data support the hypothesis that the trait complex surrounding the use of elk teeth spread from the Mandan, since they had the artifact type in early contexts, and it is absent in other complexes which are assigned to historic tribes. In Minnesota, from which state the Dakota seem to have entered the Northern Plains, there is no record of elk teeth in any archaeological complex, although ethnological specimens are known. Elk teeth are absent at the Hagen site in eastern Montana, tentatively identified as a Crow site occupied prior to White contact (Mulloy 1942).

Parenthetically, this paper points up the value of functional and historical studies of artifact types which may be shown to have significance in the culture history of the area in which they occur. Functional interpretations of artifact types have been made of the slotted-rib ice glider darts (Fenenga 1954), and of the scored animal bones used in paddling the surface of pottery vessels resulting in the parallel ridges common on much of the Plains pottery (Wedel and Hill 1942).

Several tentative conclusions and working hypotheses are derived from the data:

1. The perforated elk tooth pendant in the Northern Plains is first noted in sites of about 14th century date which show affiliation with the historic Mandan. Until about 1800 this artifact seems to have been held by the Mandan alone.

2. Elk teeth are part of a trait complex which reached its most complex expression among the Mandan, Hidatsa, Crow, Blackfoot, and Dakota.

3. The tribes who came into contact with the Mandan after about 1800 adopted the trait and its associated values. The Cheyenne, Arapaho, and Dakota acquired the trait and spread it into the Central Plains, but the indigenous tribes in that area did not have nor did they adopt the complex.

4. Because brass buttons, cowrie shells, and other circular and oval pendants frequently occur on garments, it appears that the use of elk teeth is only one technique of a style of ornamentation wide spread among Northern Plains groups.

5. These teeth are a distinctively feminine mode of ornamentation, the locus of which in archaeological sites may have significance in interpretive studies. The presence of large numbers of these pendants, for example, may aid in the identification of the sex of an indeterminate skeleton.

6. Functional interpretations and historical analysis of artifact types are not fully exploited, and such studies have real value in the reconstruction of the culture history of the areas in which the artifact type or trait complex is found.

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HISTORIC SITE ARCHAEOLOGY AT JAMESTOWN

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JAMESTOWN, site of the first permanent English settlement in the New World, furnishes an interesting example of the use of archaeological techniques to put factual meat on abstract or theoretical bones. For over half a century, off and on, a succession of historians, architects, engineers, and archaeologists have sought physical evidence in the earth to identify the location of vaguely defined landholdings and buildings, the first fort built in 1607 by the first contingent of settlers, and clues to everyday living habits as shown by utensils and implements. The immediate purpose was often salvage in advance of construction, but the final objective was interpretation of historic data. An especially intriguing challenge was to establish evidence of the first industries in British Colonial America — ship building, lumbering, pottery making, brick making, iron working, glass making, tobacco raising, and many others.

Planned, professionally supervised archaeological explorations were begun in 1934 by the National Park Service and carried on intermittently since. In the 1930's and 1940's Jean C. Harrington supervised much of the archaeological and laboratory activities. Also participating were H. S. Day, H. C. Forman, C. F. Miller, C. Benson, W. Bailey, and J. T. Zaharov. In this work 141 structures have been wholly or partially uncovered, including houses, public buildings, workshops, outbuildings, kilns, and wells. A total of 96 ditches have been located and partially traced to provide evidence of property boundaries. Nearly 100 graves have been located, some 70 comprising the earliest-known cemetery on Jamestown Island. And the only known Indian occupation site has been discovered beneath a 17th century humus zone protected by a Confederate fortification.

At first, it was hoped that existing 17th century survey records and descriptions of land tracts and buildings would supply a frame of reference into which archaeological findings would fit without undue complication. It has since been realized, however, that so tenuous is the written data that only one building can be identified with reasonable certainty, the Ludwell, Third and Fourth Statehouse row. Tract descriptions when plotted out on a modern map have little to tie on to except marshes, the river, and each other. Erosion and the vagaries of 300-year-old reference points have complicated the problem greatly.

FIG. 1. Brew houses are known to have been built as an important necessity at Jamestown. This view shows a corner of a foundation of a small brick and timber building which matches certain brew house descriptions. A pair of circular fire boxes of brick are associated with a wide chimney embayment. (National Park Service photograph.)

After many trials, including the use of probing rods, earth auger tests (thousands were made in the early 1930's, complicating later observations), air and surface inspection, a method of area exploration by 10-foot wide test trenches was adopted. However, this method was too expensive for the 1950's and current tests have brought good results by means of 3-foot trenches plotted on a 50-foot interval grid surveyed over crucial portions of "James Citty."

Recording was done by means of measured drawings of features on plats, mostly on 40-scale, by 100-foot lots or for individual structures. Building foundations sufficiently preserved to record in detail are entered on Historic American Building Survey sheets for permanent records, available at Colonial National Historic Park and the Library of Congress. Archaeological records, where complete, are written up in unit reports by area. Black and white photographs supplement these reports. In the 1940's and 1950's color 35-mm transparencies and some motion picture film were added. Lately, a few 3-D record pictures have been made of excavations. Unfortunately, no report summarizing archaeological findings has yet appeared except J. C. Harrington's 2-page summary of Jamestown archaeology in *Archeology of Eastern United States*, edited by Griffin in 1952; the National Park Service booklet, *New Discoveries at Jamestown* by J. L. Cotter and J. P. Hudson (1957); and "Excavations at Jamestown, Virginia," by J. L. Cotter in *Antiquity*, Volume 31, Number 121 (1957). Present efforts are directed toward publishing these data in 1957 and later.

The chief accomplishment of archaeological work at Jamestown has been to contribute evidence of structures, features, and artifacts which serve to define facts either assumed by history or, in some cases, not yet recorded by

FIG. 2. View looking inland (north) from south shore of Jamestown Island, showing exploratory trenches in background. In foreground the walls of a mansion-type house are being exposed and recorded for Historic American Buildings Survey. (National Park Service photograph.)

historians. Specifically, the means were provided to furnish physical data and objects with which the Jamestown story could be presented and illustrated at the Jamestown museum to be completed in 1957 and in literature for the public. For those interested in specific arts and crafts and in classes of objects, a huge collection of objects is available in the largest study collection of 17th century British colonial objects in the New World.

Before the Jamestown excavations, not one contemporaneous painting or even a sketch of a 17th century Jamestown house had come to light. None has as yet. But instead of fitting out an hypothetical Jamestown scene with English houses of the period, it is possible now to offer a series of structure foundation plans, complete with archaeological evidence of masonry types, including water table bricks, roofing tile or slate, casement equipment, interior hardware, and many other clues to enable architects and artists familiar with 17th century English construction to make pictorial reconstructions. Indeed, although knowledge is not yet exact enough (even if funds were available) to permit physical reconstruction of houses, it is possible in this way to offer interpretation based on fact, yet not inflexible when additional information allows better understanding of details. At Jamestown during the 1957 anniversary celebrations, several houses will be so pictured in exhibits which will accompany the marking of the foundation patterns on the surface of the ground in modern brick.

These pictures and markers, with reconstructed property line ditches and conjectural fences in keeping with 17th century fence design, will serve to convey to the visitor a sense of lay-out at the First Permanent English Settlement. Without archaeological investigations this interpretation would not have been possible.

Sometimes shovel and trowel have brought to light features for which no historical reference whatever was known. For example, no known record mentions ice storage at Jamestown. However, a pit was excavated which undoubtedly fits the descriptions of 17th and 18th century ice pits in England and Europe. Again, whereas it was known from historical inference that obsolescent armor and weapons were sent to the settlement in the dangerous days of the first quarter of the 1600's, any of over a dozen types of halberd could have been used. A well filled with refuse produced a good example of halberd to illustrate at least one type that actually came to the settlers. Historical references to swords at Jamestown are numerous. Yet, these could have been of a great variety, or restricted to one to 2 basic patterns. Today, thanks to the location of a large refuse dumping pit, several types are represented, with basket hilt and swept hilt rapiers, and even an unexpected cutlass, all available for study.

Workshops, kilns for pottery making, brick kilns, a simple pit kiln or "clamp" for early brick making, ironworking and smelting pits, glassmaking furnaces, and a host of other evidences of manufacturing which have been brought to light by archaeological search all give point and tangibility to activities accorded only passing and inadequate mention in historic sources. Nor is it safe to assume, as some have, that what was done in English villages of the time, or in later New England communities, adequately represents the arts, crafts, activities, and way of life that were taking form in Colonial Virginia. If Jamestown as a study has any real value, it is necessary to seek out, discover and analyze by every means possible how a new way of life developing on this continent was to become distinct from the European, how the spirit of independence was fostered by necessity-born economic innovations, self-developed arts and crafts, new homes, customs adapted to the new environment — in all, a new outlook on life which nurtured the inevitable seeds of independence. The things that men did at Jamestown have left many physical traces. By these traces we now know them better than before.

Thus, at a site where historical facts are limited essentially to personalities and events, and physical references have been lost, the archaeologist may contribute data which, if it does not write history, certainly illuminates, enlivens, and gives a 3-dimensional view of it.

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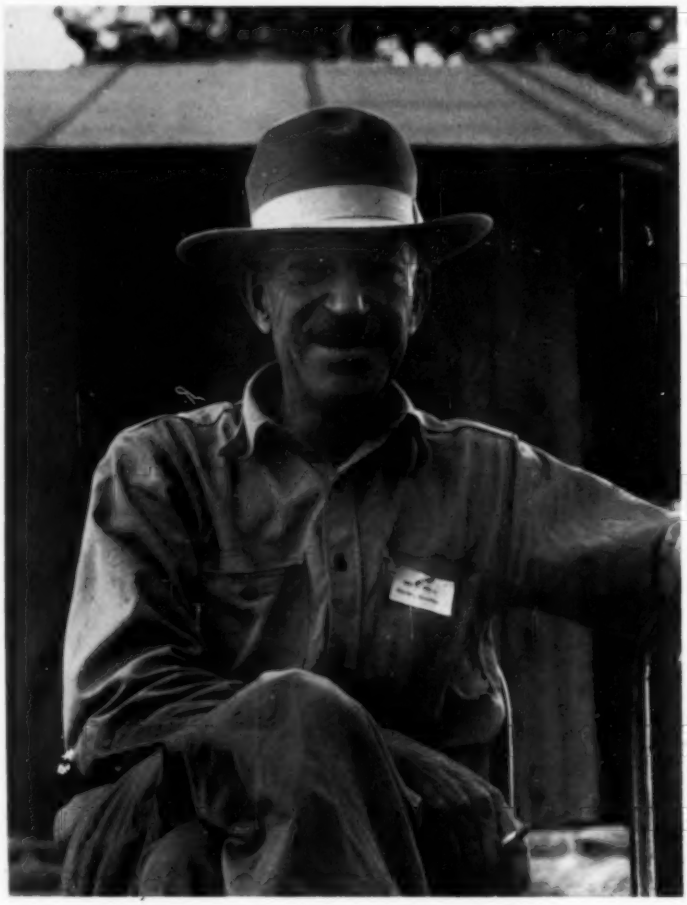
Yorktown, Va.
March, 1957



EARL HALSTEAD MORRIS — 1889-1956

"Earl, in from Boulder, met me at the Denver station — khakis, leather leggings, stiff-brimmed Stetson — most dependable man the Lord ever made." That from my diary of 1948.

Everyone, save those who knew him only in New York or Washington, will recognize that description; and everyone, East or West, who had to do with him, will echo the sentiment. For although no man's character and work can be summed up in a single word, dependable comes most closely to doing just that as regards Morris: the man himself and the results of everything he did. One could rely implicitly on the accuracy of his observations, on his reporting and evaluation of data, on the strength and lastingness of whatever he built.

Morris was born October 24, 1889, in Chama, New Mexico, only son of Juliette Amanda Halstead and Scott N. Morris. Heredity, environment, his experiences as a child and young boy, combined to make him what he was. They were, he once told me, coercive; he couldn't help becoming an archaeologist. But he never dwelt on the odds he had to overcome to reach that goal. His early life is best told of by himself as part of a paper, "My Sixty Years in Archaeology," read last May at the State Historical Museum in Denver.

"My father came to Leadville from the Pennsylvania oil fields in the mid 1870's. Gradually he acquired the horses, wagons, plows, scrapers, and other paraphernalia for construction work on a fairly wide scale: building railway grades, roads, digging canals, and hauling freight when there was no other opening. The summer and fall of 1891 he spent bringing down ore from the rich silver mines near Rico, Colorado. When the first snows made roads in the high country no longer passable, he headed his outfit south toward the San Juan valley in northwest New Mexico. He had learned that the handful of settlers who had followed the San Juan deep into Navajo country were raising quantities of alfalfa, and that feed for wintering his stock could be had cheaply. Also, the grapevine had informed him that the San Juan valley was full of ancient ruins. That interested him almost as much as the alfalfa.

"Eventually, Father's caravan reached Farmington, New Mexico, then a cluster of half a dozen houses. Mormon colonists were opening an irrigation canal farther down the valley and he put his teams to work on that project under a foreman, so he was free to begin digging. In our dooryard there was a stony mound strewn with bits of broken pottery. For days Father dug, he later told me, without uncovering anything more than stubs of wall, an occasional firepit, and a few grinding stones. Then, one afternoon, just before sundown, he broke through a wall into a burial chamber. That night he took from the earth forty pottery vessels, most of them intact. By Spring, he had a large collection. This he put on exhibit at Durango and, on his return trip to the mines, sold it to Gilbert McClurgh of Colorado Springs, where it is now in the Taylor Museum.

"The Fall of 1892 saw us again in Farmington, my father busy gathering a second collection. There was a ruin close to the log cabin we lived in that winter. One morning in March of 1893, Father handed me a worn-out pick, the handle of which he had shortened to my length, and said: 'Go dig in that hole where I worked yesterday, and you will be out of my way.' At my first stroke there rolled down a roundish, gray object that looked like a cobblestone, but when I turned it over, it proved to be the bowl of a black-on-white dipper. I ran to show it to my mother. She grabbed the kitchen butcher knife and hastened to the pit to uncover the skeleton with which it had been buried. Thus, at three and a half years of age there had happened the clinching event that was to make of me an ardent pot hunter, who later on was to acquire the more creditable, and I hope earned, classification as an archaeologist.

"1894 to 1900 Father's work took us elsewhere, but in 1902 he was back in Farmington occupied, as spare time offered, in amassing another collection of pottery. This had grown to considerable proportions by the time he was murdered in 1904."

Mr. Morris was shot while trying to get from a saloon one of his men who, he'd heard, was drunk and who he feared would be "rolled" by some local bad hombres. Both psychologically and practically, that shattering event and what it entailed, played, I am sure, a large part in bringing about Earl's deeply underlying grave, almost somber, outlook on life. This was never openly expressed, but perhaps because of it his happiness was the more intense when he was taken out of himself by some archaeological or constructional problem, the tougher the better; or when the trout were rising at some hard-to-reach little lake far up in the Rockies. I'm sure, though, that not even the biggest fish ever gave him such satisfaction as to brush the earth from the rim of a pottery bowl, preferably black-on-white ware, and find it unbroken.

Such uplifts as the unexpected find or the whacking great trout did not, of course, come to him until much later, for Mr. Morris died when Earl was but fifteen. Boys matured early in those days on the frontier and I imagine — he never talked to me of that period — he was charged with disposal of his father's outfit. His mother, I have gathered from others, was utterly prostrated and never completely recovered. So from then on — again this is guesswork, but I am certain of it — he was not only her sole support but put himself through school and college.

How he did this at first I do not know, but later in high school and at the University — this he did tell me — he worked as a mason, specializing on fireplaces and chimneys. He also told me, and it was the nearest thing to a boast I ever heard pass his lips, that no chimney he'd built had failed to draw and no fireplace of his had ever smoked. Knowing him and how he did things, I'll bet none did!

In "My Sixty Years" he says that he went on adding to his father's collection through his school days. In 1908 he entered the University of Colorado. In the Spring of 1912 he left college temporarily to join an archaeological expedition to the Maya ruins of Quirigua, Guatemala, directed by E. L. Hewett. Also of the party was Sylvanus Morley, who became a lifelong friend and in after years a close professional associate. That summer he was given funds to excavate in the high country east of the Mesa Verde, the first of many grants from the University of Colorado Museum.

He took his B.A. degree in 1914 and that winter he and Neil M. Judd, another lifelong friend, headed a group that made glue molds of the Quirigua monuments for the San Diego Exposition of 1915. His M.A. came in 1916.

Thanks to Livingston Farrand, then President of the University of Colorado, he was granted in 1905 a scholarship at Columbia. But he was too devoted to field work to put in the time necessary for the doctorate. The year in New York, however, had the important result of his becoming known to Clark Wissler of the American Museum of Natural History, who gave him what he calls his "first great opportunity." This was to direct the excavation of Aztec, one of the largest, best preserved, and archaeologically most rewarding of ancient Pueblo ruins.

Although Morris investigated many Southwestern sites of all periods, Aztec was closest to his heart. He was in charge of the work there from 1916 to 1924 and the resultant publications are among the classics of Southwestern archaeological literature. Aztec was not only thoroughly dug, but the magnificent masonry of its walls was painstakingly repaired and stabilized. Later, his services loaned to the National Park Service by Carnegie Instiutution, he accurately restored and reroofed Aztec's Great Kiva, a tall-columned, 50-foot subterranean ceremonial chamber into which one cannot descend without wonder at the power of the religion that inspired so splendid a structure. Nor can one fail to admire the devotion and the skill of the man responsible for its recreation.

A radical change of scene came in 1924, when Sylvanus Morley launched the Carnegie's program of excavation and restoration of some of the finest of the many buildings of Chichén Itzá in Yucatán. Earl was obviously the man for the job. Like Aztec, the Temple of the Warriors at Chichén is a monument to his skill. It also testifies to his engineering genius, for after that great structure had been cleared, the fallen parts of its walls rebuilt, and its 20 tall sculptured columns re-erected, the final work on its substructure revealed that beneath it were wonderfully preserved remains of an earlier building. Obviously, this too had not only to be excavated for study, but if possible its carved and brilliantly painted walls and columns be made permanently accessible. I was at Chichén at the time. I could not see how on earth this could be done. But it offered just the sort of challenge that Earl loved, as did his Norwegian disciple Gustav Stromsvik, who later did such admirable excavation and repair at Copan in Honduras. Nothing could stump that pair, nor did this seemingly hopeless problem. So that now the Warrior's Temple stands safely supported above; and below, in perfect preservation, is what the ancients had spared of the Temple of the Chac Mool.

But I'm getting ahead of myself, or rather Earl, because in 1923 he had married Ann Axtell, a vivid and brilliant girl, who after graduating from Smith had spent a season in France with the School of Prehistoric Research. At Chichén with Earl, she meticulously copied the paintings of the 2 temples, working with Jean Charlot and, during 2 long visits, with Joseph Lindon Smith. She and Charlot were coauthors with Earl of the splendid monograph, *The Temple of the Warriors*. She also wrote a charming popular book, *Digging in Yucatan*, to which she later added the equally delightful *Digging in the Southwest*.

Yucatán, however, could never take the place, for Earl, of the San Juan country. Being often at Chichén during his 5 years there, I sensed, and he finally told me, that he itched to pull out. Morley realized this and in 1929, with characteristic generosity, most regretfully let him. Thus, in 1929 Carnegie Institution entered the Southwestern field.

As a matter of fact, Earl had never lost touch with it, for each summer the Carnegie was glad to have him spend such time as he could spare from reports, on excavations for the University of Colorado and the American Museum in the caves of Canyon del Muerto and in surface ruins in the La Plata valley. And when the Warriors monograph was off his hands, he was free to devote himself entirely to the reasoned attack on Anasazi (Basketmaker-Pueblo) prehistory that occupied him for the rest of his life. His program was based on the great amounts of information for certain areas and periods already gathered by himself and others. These data, however, were patchy and uncorrelated. Chronology, too, was uncertain, both absolute and as regards the relative ages of the many cultures and subcultures represented.

Morris' interest in the latter problem had early been aroused by N. C. Nelson's stratigraphic work in the Galisteo Basin and his own similarly established determination that the Chacoan builders of Aztec had been succeeded there by Mesa Verde people. But most appealing to him, because it could yield dates accurate to the year, was dendrochronology. Clark Wissler, the first anthropologist, I believe, to grasp the great potential value for Southwestern archaeology of A. E. Douglass' discovery, wrote Earl of it in 1917. Shortly after, Douglass himself appeared at Aztec. Earl says: "I had a good sized stack of timbers too short for re-use. I turned him loose on that woodpile and he was busy as a beaver all day. That evening, by lantern light in my small room in the ruin, he spread out samplings he had taken and explained how he was building up a sequence of overlapping tree-ring patterns. I could see he was working on something big and from that day I became an ardent collector of wood." His scores of specimens, gathered through the years, have been a highly important contribution to the materials for dendrochronological research. Those from early cave sites in Canyon del Muerto and Durango, Colorado, have enabled Douglass to build back his sequence unbroken to 49 B.C. From Durango also came a "floating" series that may carry precise dating considerably further back.

Morris' special concern with chronology stemmed from his lifelong preocupation with the history of Anasazi culture, which he believed, I am sure rightly, to have developed its characteristic traits in, and to have exerted potent influences widely outward from, the San Juan drainage. In almost all parts of this vast area he had explored and dug. His greatest contributions were based on work in the La Plata and Animas valleys, twin northern tributaries of the San Juan. That was bred-in-the-bone country, his first little pot having come from close to the mouth of the Animas. Higher up that stream lies the great Aztec ruin; above Durango, still farther up, his last excavations brought to light the only early Basketmaker dwellings so far known. The La Plata was equally productive. Part or all of 8 field sessions he devoted there to selected sites typical of each major stage, from Late Basketmaker to terminal Mesa Verde. He thus covered the entire life of the pottery-making San Juan peoples. His La Plata monograph treats every type of artifact in detail, as well as burials and La Plata architecture, from what he aptly terms protokiva pit houses to fully matured pueblos. His masterly introduction sets forth graphically the rise, development, and culmination of the local Anasazi culture. The story, centuries long, ends only with the devastating drought of 1276 to 1299. The La Plata ruins, however, were unprotected from rain or the water of melting snow and therefore yielded only objects not subject, or highly resistant, to decay. The same is true of nearly all Animas sites. So, to complete his picture, Morris had early turned to the bone-dry caves of Canyon del Muerto and later to those of the Prayer Rock district. From these could be recovered, often in astonishingly perfect preservation, sandals, basketry, textiles, wooden implements, foodstuffs, and the countless other perishables that bring an ancient culture so vividly to life. The caves rewarded him richly with such materials of all periods.

Throughout his career, Morris was doubly motivated. First, of course, by the urge to trace the course and discern the causes of historical events and cultural developments. Secondly, by an exceptionally ardent wish to make evident to the world of today the achievements of the past. Back of this was his own admiration for and striving to preserve all ancient things that were beautiful and soundly made. I think he may also have felt, perhaps subconsciously, an obligation to repay, by rescuing their work from oblivion, the men and women of long ago whose artistry and manual skills gave him such keen and lasting pleasure.

Both aims were served by his untiring field activity: on the one hand to gather factual data; on the other, to salvage material evidence of fine workmanship of every sort. One aspect of such salvage was his effective effort to give permanence to the best of Anasazi architecture. To that end he labored long on the stabilization of Aztec's walls and that he capped by his wonderful restoration of the Great Kiva. With the aid of J. A. Lancaster, who still carries on at Mesa Verde, he skillfully strengthened several seriously threatened parts of Cliff Palace. He did the same for the tall central building in Mummy Cave, Canyon del Muerto; and in de Chelly, by a long wing-dam and judicious planting, he protected from further flood erosion the lower structure of White House.

His love of fine pottery led to the gradual building up of a unique personal collection of notable examples of nearly every principal Southwestern ware. Each piece had to be bought or swapped for, because during his whole career he was a staff member of one scientific institution or another, to which of course went whatever he unearthed. But exceptional vessels kept becoming available: washed out by earth-hungry arroyos, hit upon in public or private works, dug by pot hunters. Whenever he learned of such a piece he went after it. One he showed me with great pride he'd had his eye on, he said, for 20 years.

After his death, these specially selected vessels, as well as his library, were acquired by the University of Colorado, whose museum was already in possession of the results of a number of his most fruitful excavations. Additional important Morris collections are in various museums: at Aztec National Monument, Mesa Verde National Park, the Arizona State Museum, Laboratory of Tree-ring Research, and the American Museum of Natural History.

During the first years at Aztec Morris worked much of the time alone or with a single helper. And later, when such economy was no longer necessary, his excavations were always made with the smallest possible number of men adequate for what he had in mind to do. This enabled him to keep close tabs on what was going on and also, I suspect, allowed him to take a hand in the digging, for wielding shovel or axe gave him the greatest pleasure. I've never seen cleaner or surer chopping and his digging was pure artistry. He'd studied the handling of the long handled shovel as a professional golfer studies his swing. Only Ole Owens and Oscar Tatman, devoted assistants year after year, came near being his equals as earth movers.

After his final diggings of 1940 below Durango, he possessed extraordinarily full information, in very large part of his own gathering, on the archaeology of the San Juan. This he set himself to make ready for publication, a tremendous task, because of his many years of work in one of the richest archaeological areas of the Southwest. Furthermore, his wife underwent a long and crippling illness, only ended by her death in 1945. Through those years he cared for her tirelessly. He also had responsibility for 2 young daughters, Elizabeth Ann and Sarah Lane, born in the early 30's. Concern on that score was mercifully taken from his shoulders by his marriage to Lucile Bowman, the most perfect companion and helper. To her, the wise and understanding principal of their primary school, the girls were already devoted.

With all domestic worries over, able to profit from the faithful and intelligent collaboration of Robert F. Burgh, as well as the extraordinary skill of Jean Ziegler in the delicate dissection and beautiful drafting of the incredibly complex weaves of the "cloth" sandals, it seemed that Earl could hope to complete his program. But a ruptured vertebral disc, which caused agonizing sciatica, necessitated a serious operation in 1949 and long confinement in a trying cast.

He was never, I think, really well again. Nevertheless he kept courageously at work, completing with Burgh the monograph on the Durango Basketmaker sites. Much, too, had been done on the sandal monograph and those on Late Basketmaker houses and pottery. Some part of this invaluable material is to be prepared by his daughter Elizabeth, a graduate student under Emil W. Haury at Arizona. Joe Ben Wheat of the University of Colorado has likewise offered his help and can also be counted on to make available others of Morris' large collections. But no other can produce the final work he had planned and of which we often talked. It was to bring the beloved Anasazi back to life in the stupendous country that was theirs — and his. He was a never failing master of exactly the right word. One can catch between the lines of all his writings a hint of what he could have done. Only a single essay, "Exploring in the Canyon of Death,"

allows his light to shine a little through an ingrained reticence and for those who have known the canyons, the note he there tells of drawing from the long-silent Basketmaker flute can never quite fade away.

Of Earl's interests and professional accomplishments, I have spoken. His scientific career will be more fully treated by Robert Burgh in *The American Anthropologist*. But his real greatness was of the spirit: gentleness, true humility, unfailing readiness to help, utter sincerity, innate appreciation of quality in people and things. One realizes the loss his passing has caused to our never too great stock of first-rate minds. But that is overshadowed, to those who lived and worked with him, by the loss of a friend on whom they could unquestioningly rely.

At Aztec, his ashes are to be scattered over the walls he rendered so time-defying. They will become one with the bit of earth that in life was always so much a part of himself.

A. V. KIDDER

DEGREES AND HONORS

University of Colorado, B.A. 1914; M.A. 1916; Sc.D. *honoris causa*, 1942; Alumni Norlin medal for Distinguished Achievement, 1931.

American Anthropological Association, the Alfred Vincent Kidder Award for achievement in American archaeology, 1953.

The Earl H. Morris Scholarship Fund for Archaeology, University of Colorado, established posthumously in his memory.

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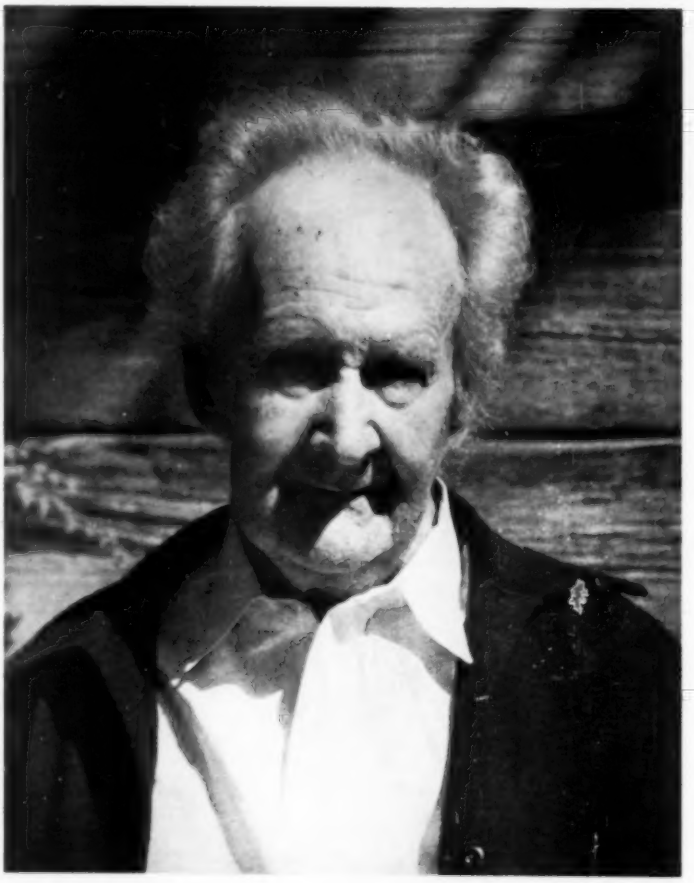

JAMES KELLY HAMPSON — 1877-1956

The death on October 8, 1956, of Dr. James K. Hampson of Nodena Plantation, near Wilson, Arkansas, leaves the northeast Arkansas region bereft of one of its most dedicated archaeological scholars and one of its most generous and gracious personalities. From his childhood Dr. Hampson collected and preserved archaeological specimens, and at the time of his death his collection contained more than 40,000 items, found and cataloged under his supervision. I spent 3 months in the fall of 1953 studying this remarkable assemblage, and I am very grateful for the opportunity which that study gave me to become acquainted with him and his family.

James K. Hampson was born in Memphis, Tennessee, on July 9, 1877, and spent his youth in that city at Shadowlawn, the home of Louis Hanover, his maternal grandfather. When 10 years old he traded a cat's eye agate marble for an arrowhead and thus his collection started. He began to pick up arrowheads on his grandfather's place in Memphis and later excavated some burials on the family's plantation, Nodena, in Mississippi County, Arkansas, where he was to spend a great portion of his life.

In 1898 he graduated from the old College of Medicine, now a part of the University of Tennessee Medical School, and after attending New York Polyclinic School practiced medicine for more than a quarter of a century at Nodena, Memphis, and Fort Smith, Arkansas. One of his deepest regrets was that during his residence at Fort Smith he did not have the interest or time to work at the nearby site of Spiro, which was to be plundered some years later. However, it was not till 1927, after a short sojourn in California, that Dr. Hampson returned to Nodena and took up again his boyhood hobby of collecting Indian relics. He turned his avocation into a sincere and painstaking study of the local aboriginal remains.

As chance would have it, Upper Nodena, the north third of the plantation, included a large Mississippian village site (10-Q-1), which was untouched save for the washing out of some pottery vessels in the burial area, during a levee break in 1897. Unaccountably, Clarence B. Moore and his good ship, *Gopher*, passed it by after making local inquiries, and the study of archaeology was thus enriched, for the site was left to Dr. Hampson's careful research which extended over a period of more than 15 years, not including his boyhood excavations around the turn of the century.

In 1932 the excavations at the site were increased through the generosity of Dr. Hampson when he permitted the Alabama Museum of Natural History under the direction of Walter B. Jones and the University of Arkansas under the direction of Samuel S. Dellinger to uncover some 1300 graves, with the hundreds of associated pottery vessels and other artifacts going to the respective institutions. This cooperation with members of the archaeological profession characterized Dr. Hampson's whole outlook; James A. Ford, George I. Quimby, James B. Griffin, and Philip Phillips are among those who have benefited from his generous nature.

Dr. Hampson also profited from this encounter with professional archaeologists in the early thirties, and his cataloging system, methods of excavation, and recording of burial data were improved. By 1942 Dr. Hampson had excavated more than 1000 burials at this one site, 785 of which were carefully located on a master site plan, along with the 62 structures he had also uncovered. He excavated a low mound which proved to be the base for a large circular structure probably of ceremonial nature, and he made extensive test digs in the main temple mound and the village area.

While confining his major interest to the Nodena site, he also made minor excavations at a half a dozen other sites within the vicinity, including two across the river in Tennessee. These sites all yielded material attributable to the Nodena phase of the Late Mississippi period. Only for a short time did he venture very far afield, and that was to excavate several caves in the Ozark Plateau where he encountered Ozark Bluff Dweller material.

By 1937 the collection had grown so large that it was necessary to move it from the house to the old plantation commissary nearby, where it remains today, a monument to his patience and hours of work. In 1946 the building was formally dedicated as the Henry Clay Hampson II Memorial Museum, in memory of Dr. Hampson's son, shot down over Burma in the last war. The Nodena Foundation, with Kenneth L. Beaudoin as its president, has attempted to raise funds to install this valuable collection within a fireproof structure, but has not yet succeeded in its goal. It is a cruel circumstance that, despite the fact that Northeast Arkansas is one of the richest archaeological areas in this country, there is not a single museum in the area, save for the Hampson collection, which can adequately present this portion of its prehistoric heritage to the public.

Dr. Hampson brought an inquiring mind and a sound knowledge of the scientific method to the subject of archaeology. He was acquainted with the basic literature in the field, and his own methods equaled those of his professional colleagues working in the area at the same time. He was not prone to idle or fanciful speculation and never over-valued any of his discoveries just because they were his own. Indeed, his treatment of the Island 35 Mastodon and its possible associated artifacts (see the article in this issue) was an example of this

attitude. He fully understood the implications of this find and told them to any one who would listen. But he always presented the information in such a restrained and cautious way that one was apt to underestimate its worth.

He never published anything on his work; that will be the task of others, and I am proud to be one of them. He did write several short papers for oral presentation and began a manuscript on the archaeology of the area. I have incorporated these writings in an Introduction for the Nodena report, and before his death he saw and approved this section of the volume now in progress.

Dr. Hampson had suffered from heart trouble for almost 10 years. He was bedridden for some years, but until recently he had recovered with amazing vitality. His mind remained active and inquisitive, and his memory was almost unfailing. He is survived by his wife, Frances Lacost Hampson; 2 daughters, Dixie Durham of Nodena and Mary Louise Melody of Little Rock; 2 sisters and 2 grandchildren. His field work in Northeast Arkansas stands as a remarkable contribution to archaeology by one of its devoted friends.

STEPHEN WILLIAMS

FREDERICK WEBB HODGE — 1864–1956

Known from coast to coast and far beyond as editor, anthropologist, historian, and man of letters, Frederick Webb Hodge came to the end of a long and exceptionally full life in Santa Fe, New Mexico, September 28, 1956. In another month his local friends would have celebrated his 92nd anniversary. We are indebted to Lonnie Hull, photographer, and to the Southwest Museum for the accompanying recent photograph.

Born to Edwin and Emily (Webb) Hodge in Plymouth, England, October 28, 1864, Fred was brought by his parents to the United States at the age of seven. He attended public school at Washington, D.C., and Columbian College (now George Washington University). He was awarded the honorary degree of Sc.D. by Pomona College in 1933, an LL.D. by the University of New Mexico in 1934, and the degree of Litt.D. by the University of Southern California in 1943.

After college Hodge was employed for a time as secretary in a Washington law office; later, from 1884 to 1886, as stenographer in the U.S. Geological Survey. His initial anthropological experience came in 1886 when he was chosen by Frank Hamilton Cushing, the director, as field secretary of the Hemenway Southwestern Archaeological Expedition, organized in Boston for explorations in New Mexico and Arizona. Serving with this organization through 1889 he became familiar with the Indians of New Mexico and Arizona, archaeological field methods, and the wealth of maps and documentary evidence collected for the Expedition by Adolph E. Bandelier. From this beginning Hodge eventually came to be recognized as one of our foremost authorities on Spanish colonial history and the various Indian tribes of the Southwest.

Returning to Washington in the summer of 1889 Hodge was appointed to the staff of the Bureau of American Ethnology. With but little delay his older associates, those stalwarts of yesterday including J. Owen Dorsey, H. W. Henshaw, Garrick Mallery, Washington Matthews, and James Mooney, learned to rely upon his knowledge of Southwestern tribes and their surroundings. We find a note from him in Mindeleff's "Pueblo Architecture" relative to stone rings at the old Zuni ruin of Halona. George Parker Winship acknowledged his aid in preparing the list of reference works in *The Coronado Expedition, 1540-1542*. He assisted J. Walter Fewkes in excavations at Sikyatki in 1895; in further archaeological researches along the Little Colorado in 1897; elsewhere in 1899. To verify an Acoma tradition, sometimes doubted, he scaled the Enchanted Mesa at the request of the Bureau in 1897 and brought back a few potsherds from the summit. His documentary knowledge and divers activities were recognized in nearly every annual report of the Bureau published between 1891 and 1925.

In 1893 when the Bureau of American Ethnology moved to the sixth floor of the Adams Building, 1333-1335 F. Street, N.W., Hodge was appointed librarian in addition to his other duties and he not only cataloged and rearranged its 2600 volumes but soon doubled their number through an expanded exchange program. By July, 1894, he was doing the major share of the Bureau's editorial work and, at the same time, was collecting and arranging material for the proposed "Synonymy or Cyclopedia of Indian Tribes." He compiled (1897) the Bureau's first list of publications and revised it at intervals thereafter.

In 1901 Hodge transferred to the Smithsonian Institution as executive assistant in charge of International Exchanges but rejoined the Bureau of American Ethnology 4 years later to take full charge of the "Synonymy." As *The Handbook of the American Indians North of Mexico*, published as Bulletin 30, Parts 1 and 2, in 1907 and 1910, this famed 2-volume work speedily won international laurels and remains today one of the foremost contributions to American anthropology. Hodge was briefly in charge of the whole Bureau during the summer of 1893 but his administrative ability was more fully recognized January 1, 1910, when he was designated Ethnologist-in-charge. In this capacity he served with mounting distinction until February 28, 1918, when he resigned and moved to New York City.

In New York, as its anonymous editor and assistant director, Hodge brought increased prestige to the Museum of the American Indian, Heye Foundation. This new association also provided opportunity for resumption of archaeological field work. Jointly with the director, George G. Heye, and George H. Pepper, a staff member, he excavated and reported upon (1918) the Nacoochee Mound, in Georgia. This was followed in 1919 by organization of the Museum's Hendricks-Hodge Expedition for explorations at the historic Zuni villages of Hawikuh and Kechipauan, identified as among the original "Seven Cities of Cibola." Owing to factors beyond control of the 2 principals, the major report on these extensive researches never came to press although a number of lesser papers appeared under Hodge's signature, including the following: "The Age of the Zuni Pueblo of Kechipauan" (1920), "Hawikuh Bonework" (1920), "Turquois Work of Hawikuh" (1921), "Circular Kivas near Hawikuh" (1923), "Snake Pens at Hawikuh, New Mexico" (1924), "The Six Cities of Cíbola, 1581-1680" (1926), and "A Square Kiva at Hawikuh" (1939). His definitive *History of Hawikuh* was issued in 1937 as the first number under the Frederick Webb Hodge Anniversary Publication Fund, administered by the Southwest Museum. The final Hawikuh reports, it is now believed, are to be published by the Museum of the American Indian, Heye Foundation.

In 1932 the Board of Trustees chose Hodge as director of the Southwest Museum, an institution founded by his long-time friend, Charles F. Lummis, and one in which anthropology and Spanish-American history are fortunately and naturally blended. Here, during what may have been the happiest period of his life, Hodge served with increased distinction until, following a sabbatical year, he retired in 1956 as Director Emeritus and moved to Santa Fe.

With its strong Spanish flavor, its historical background, its libraries and musesums, its nearby Pueblo villages and their ruined predecessors, Santa Fe had long been an irresistible magnet. Returning to New Mexico after many years on the east coast and the west, Dr. Hodge carried with him plans for several old and new research projects. Among these was a fresh study of the Apache, made for the Department of Justice in connection with Indian land claims.

Throughout his life Frederick Webb Hodge was an indefatigible worker. He crowded 2 days into one. The total product of his extracurricular industry is incredible. He was a member of the Anthropological Society of Washington and a contributor to its *American Anthropologist* as early as 1891; he served annually on the Society's editorial committee and was elected secretary and managing editor in January, 1899. He was a founder of the American Anthropological Association and editor of the *American Anthropologist*, new series, from volume 5 (1903) through volume 16 (1914). He not only edited all the publications of the Bureau of American Ethnology, the Museum of the American Indian, and the Southwest Museum during his administrative connection with these institutions but he also edited, among others, Edward S. Curtis's *The North American Indian*, a monumental work in 20 volumes and 20 portfolios, the Holmes Anniversary Volume (1916), and the several reports of the XXIII International Congress of Americanists (1928); moreover, if the subject matter was difficult and complex, he insisted upon preparing the index himself.

During this same period Hodge enriched numerous other historical and scientific monographs with his introductions or annotations. He was a founder and one of the editors of the Quivira Society whose 12 volumes record in superb format otherwise unavailable documents relating to Mexico and the Spanish Southwest. Altogether, his bibliography includes more than 350 titles and is to be published, with a fuller biography, by the Zamarano Club of Los Angeles. Hodge was long a Trustee of the School of American Research and of the Laboratory of Anthropology, in Santa Fe, and a member of a dozen or more literary and scientific societies in this country and abroad.

To his intimates Hodge was affectionately known as Téluli, a name given him in December, 1886, by the 3 Zuni whom Cushing had taken east and who were returning with him and his party to inaugurate fieldwork of the Hemenway Expedition. A folktale related by one of the Zuni en route told of a field mouse happily digging holes on sacred Corn Mountain and singing "Téluli, téluli" as he dug — until a hawk flew over. And from that chance story young Hodge, a gay and interested bystander, became Téluli. Literally translated "dig your cellar," the name was singularly prophetic for a dirt archaeologist. (We are indebted to Mrs. Hodge for this corrected version of the naming and for other factual matter herein.)

Despite an outward appearance of casualness, Frederick Webb Hodge was a methodical person. He had to be to keep order in his over-full hours. There was a rare gentleness about him, in the office or at home; one finds an old-fashioned clarity and preciseness in all that he wrote. Yet he was fun-loving, a practical joker, and a wonderful story-teller. His fund of anecdotes about Smithsonian associates, for example — Secretary Langley, Major J. W. Powell, W J McGee, Gerard Fowke, Matilda Coxe Stevenson, and others — enlivened many a dinner table. He was a gracious host and an ever-welcome guest.

Hodge was first married to Margaret W. Magill, a sister-in-law of Frank Hamilton Cushing, August 31, 1891; later, to Zarah H. Preble, who died in 1934. With him through most of his directorship of Southwest Museum and through the months of retirement in Santa Fe was the present Mrs. Hodge, the former Gene Meany, artist and author, who composed late in 1956 the following personal tribute:

TO
FREDERICK WEBB HODGE

By

GENE MEANY

The Corn was ripe,
  The harvest abundant,
In the Autumn of his life,
  (Winter never came),
When Aspen covered the Mountain tops
  With Golden light against Turquoise skies;
When fragrance of early piñon fires
  Scented the air in the Land he loved,
This Land of his returning.

After a happy day in the mountains,
  Fred quickly slipped away.

"It is finished in Beauty,"
  Says a Navaho prayer, and
All who love Téluli know

"Beauty is before him as he goes,
  Beauty is behind him,
He walked in Beauty,
  In Beauty . . . it is finished."

NEIL M. JUDD
M. R. HARRINGTON
S. K. LOTHROP

FACTS AND COMMENTS

PHOSPHORUS ACCUMULATION IN SOIL OF AN INDIAN HABITATION SITE

At the former habitation sites of aboriginal Indians considerable animal refuse must have been discarded close to their tents or houses. This material would have been largely composed of animal and bird bones, fish remains, and so on, rich in phosphorous. Accumulations of these wastes would have been left behind after abandoning the place, to slowly decay and percolate into the soil by rainwater.

In the humid regions, the visible evidence of such remains may have long since disappeared on an old campsite; however, the soil must have been enriched in phosphorus, and this enrichment might still be ascertainable by soil analysis. With this in mind, my nephew, Theodore Peck, who is a soils student at the University of Wisconsin, and I did a soil sampling job at a location on my farm where I was quite certain that Indians had camped in the past. Peck was encouraged in this work by his instructor, Gerhardt Lee, who is with the Soil Division of the Wisconsin Geological and Natural History Survey, and by David A. Baerreis, Department of Anthropology, University of Wisconsin. I had served as a county agricultural agent in Wisconsin and thus have had considerable contact with farm and forest soils. The interest in this project was mutual among us.

The site chosen was located adajcent to a marsh, and had been plowed many times in farming. Arrowheads and scattered chips of chert indicated former habitation. However, no pieces of bone remained, so there was no visible evidence of the places where refuse may have fallen. When grain such as oats or wheat was planted in this locality, the growth was very irregular, some spots being normal and others exceedingly productive.

A tract 50 feet square was marked off, and subdivided into 5-foot squares, and a soil sample taken from the center of each small square. This made a total of 100 samples from the tract. The samples were taken 2 or 3 inches below the plow sole to avoid any soil disturbance due to previous tillage.

Modern soil science has shown repeatedly that where soluble phosphate is applied to the soils within the humid regions, and where the pH is on the acid side, such soluble phosphate is quickly fixed in the soil by aluminum, iron, and calcium ions. The first two give the strongest fixation, and the lower the pH number of the soil the more aluminum and iron ions there are in circulation within the soil water of the mineral colloids. The pH of this tract was 5.3, showing that this soil had strong powers of fixation.

We were not sure when we did the soil sampling that we would find abundant available phosphorus in the subsoil layer. However, there was the element of time; decaying bones, the soluble phosphates of which were first fixed in the upper layer of soil, may have yielded enough phosphorus to slowly leach into the subsoil horizon. We found that since the time of occupation enough fixed phosphates had moved downward for decisive testing. We felt, however, that there would be a limited lateral movement of the fixed phosphates, and the tests seemed to bear this out.

The samples from this habitation site were tested by Peck in the Soils Laboratory of the College of Agriculture, using the Truog method of determination. The "available" phosphorus was determined; not the total phosphate. The "available" phosphorus in a soil sample is made by soaking a measured amount of soil in a mild acid for a definite length of time, and then measuring the amount of dissolved phosphoric acid in the filtrate. This can be done by quantitative colorimetric methods, and the samples can be operated upon rather rapidly. Total phosphorus determinations are slow to make. This "available" phosphorus determination is used in finding the fertilizer needs of soils, and the phosphorus determined by this method roughly approximates the amount that is useful for growing crops. Soils men express this in "pounds per acre."

In Figure 1 may be seen the picture of the soil in this 50 by 50 foot tract on the habitation site as represented by the figures for available phosphorus determinations. These range from a low of 60 up to 560 pounds per acre. After the results of these tests were graphed as seen in the drawing, we were surprised to find some of the very low values adjacent to high values in other squares. Were the places of lowest value the ground covered by the domiciles, and the places of higher value the ground outside that had received the refuse? It may be wishful thinking, but this seems possible. When we took samples in Squares 2 and 58 we encountered fire pits. In both these squares additional samples were taken 10 inches lower than the first for comparison tests of the upper and lower portions of the fire pits. The figures for the deeper tests in the fire pits are prefixed by the letter B. Phosphates accumulate from the burning of wood, but at a far slower rate than the accumulation from bones. Besides, if the dwellings had been lived in for any length of time, say a full winter, the fire pits would have had to be emptied from time to time. The contents of these pits would then have been thrown on the ground outside.

The figures for Squares 5, 19, 36, 59, 65, 78, 91, and 95 are all rather low as compared to the remainder of the squares. Their average comes to 71 pounds per acre. These points of soil sampling probably did not have any additional phosphorus added to them when the Indians occupied the location, and they indicate the average basic fertility of the soil after many years of cropping. The richer portions of the tract also lost available phosphorus during the years of cropping, and they may be depleted by at least 100 pounds. Therefore, if these tests had been made when the soil was in a "virgin" condition, higher figures would have been obtained for all the squares. This may be believed from a study of the second tract. The figure of 71 pounds per acre given above might be called the "background" average, and this is

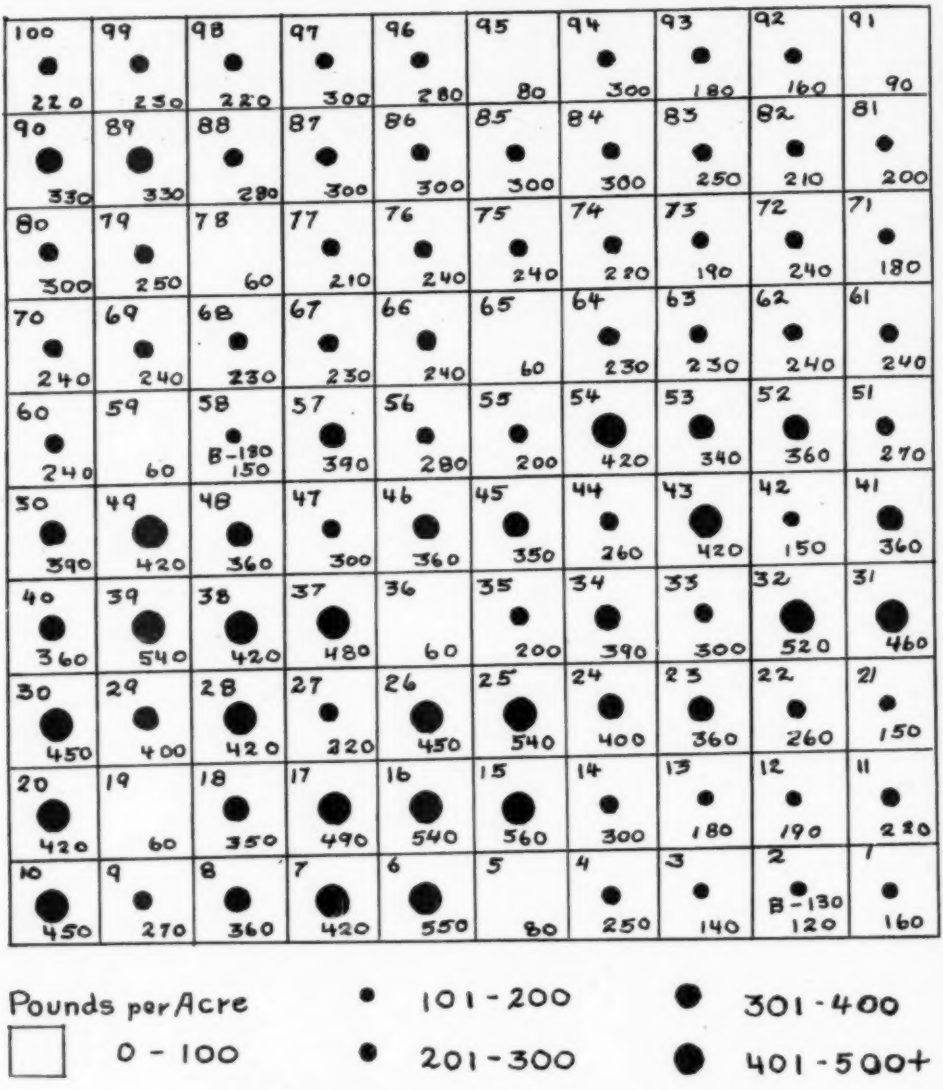

FIG. 1 [Dietz]. Available phosphorus measurements (in pounds per acre) from an Indian habitation site (Tract 1). Soil samples were taken in the centers of 5-foot squares, from top of subsoil below plowed zone. Deeper samples, marked B, come from fire pits in Squares 2 and 58.

100 125	99 175	98 180	97 180	96 150	95 125	94 200	93 210	92 175	91 175
90 220	89 210	88 190	87 220	86 190	85 200	84 160	83 110	82 150	81 160
80 180	79 190	78 220	77 190	76 150	75 190	74 160	73 115	72 110	71 175
70 200	69 190	68 190	67 180	66 175	65 140	64 150	63 150	62 175	61 200
60 240	59 190	58 205	57 210	56 180	55 180	54 160	53 180	52 180	51 180
50 190	49 180	48 240	47 190	46 240	45 180	44 210	43 210	42 175	41 180
40 250	39 200	38 210	37 220	36 240	35 220	34 210	33 210	32 160	31 230
30 180	29 40	28 230	27 200	26 300	25 140	24 220	23 300	22 100	21 210
20 260	19 240	18 210	17 210	16 300	15 190	14 240	13 260	12 210	11 180
10 350	9 260	8 200	7 300	6 310	5 300	4 210	3 230	2 210	1 200

Pounds per Acre

0 - 100 • 101 - 200 • 201 - 300 ● 301 - 400 ● 401 - 500+

FIG. 2 [Dietz]. Available phosphorus measurements (in pounds per acre) from a location lacking evidence of Indian habitation (Tract 2).

the average of the tract independent of refuse contamination.

Figure 2 is the record of a 50-by 50-foot tract of soil at a place about 1000 feet from the first. The first tract is near the marsh; the second away from the marsh, where the evidence of Indian occupation is almost nil. Two or 3 chips were found on this tract; that is all. Screen tests of the subsoil in several places did not yield chips, so it is quite likely that the tract was not occupied to any extent. No fire pits were encountered. In this tract the general level of phosphorus determinations is more uniform. However, the "background" average is much higher than that of the first plot. The reason for this seems to reside in the number of years the land was cropped. The first tract was cropped for at least 90 years, the second for not over 25. So the original available phosphorus has not been reduced so much in this second tract as in the first. The background average for Tract 2 is difficult to estimate, but if 20 of the lowest squares were averaged the figure would be higher than obtained in Tract 1.

In Figure 2 there are a couple of high spots. One appears in and around Square 6, another in Square 10. It is hard to be sure what caused the increased available phosphorus in these spots. However, there is the possibility that large animals died here in the past and the phosphorus content of their bodies was incorporated into the soil. If, for instance, a mammoth or mastodon had died here, a lot of phosphorus would have been added to the soil, and the coverage would have been considerably more than a 5 foot square. A dead elk might have added a considerable amount where its flesh and bones decayed. It would have been surprising, indeed, to have had a uniform grid of tests over the 50 foot square. The low spots in squares 22 and 29 are difficult to explain, and the writer will not attempt to do so. So far as I am aware, this type of grid testing for available phosphorus has never been done before, so there are no known patterns of soil behavior for comparison. Perhaps another soil sample taken within an inch or two of the first might show the average background tests. This was not done.

As stated earlier, only one soil sample was taken from the center of each 5 foot square. No composite samples were obtained. A special soil probe was used, and the soil sample carefully selected from the bit of the probe. We did not want to get any average sample from each square since we did not know how sharp a line of demarcation between values would be obtained. A more perfect picture of the tracts might have been obtained if the samples had been taken within squares of 2½ feet. This would have entailed the testing 400 samples on a 50 foot tract, and this seemed like a lot of samples to test.

The soils of the 2 tracts discussed in this article were almost identical in character, each being a sandy loam of good quality, of glacial origin, containing some small stones. Their content of colloids was sufficiently high to make them a good oak and hickory hardwood soil.

It is obvious that there is a decided contrast in the pictures of the 2 tracts. The phosphorus tests of Tract 1 demonstrate why the crop response was so good in places. Along with the increased phosphorus there must have been concomitant increased nitrogen content. No available nitrogen tests were made, although from the theoretical soils standpoint such tests should be of interest. However, from the standpoint of archaeology the phosphorus tests are sufficient. In practice the 5 foot spacing should be sufficiently close for a campsite.

Testing for available phosphorus is not difficult in itself. If one runs 10 tests at a time, and has plenty of wash water and a sink to wash the tubes and glass funnels, 100 tests may be run within a couple of hours. In the field such testing would be slower, although with a properly constructed field kit and sufficient wash water a number of tests can be made in a short time. Soils men often use a field kit for this purpose. For archaeological purposes exact tests are not too important; comparative tests are. To learn how to make these tests the archaeologist would have to spend a day in a soils laboratory, or have a soils man show him how to do them. The reagents are inexpensive.

There may be practical uses for phosphorus tests in field archaeology. In the past, all archaeology in the field has been based on visible evidence of occupation and burial. However, if the archaeologist were suspicious of an area that did not offer visible evidence of occupation, testing for invisible evidence might be useful in pinpointing an area of former habitation. For instance, on a site that had never been plowed, but which showed aspects of favorable location, the archaeologist might satisfy himself as to whether he had an occupation site by means of phosphorus tests.

O. Arrhenius (Anonymous 1941), a Swedish soil chemist, noticed anomalies in the available phosphorus content of field soils of that country which seemed to be beyond the normal variations that should be encountered. He discovered that he could locate old abandoned village sites, some which dated into the Old Stone Age, by testing the soil. He also found that the old trails leading into these abandoned villages were richer in phosphorus and could be traced across country.

E. M. Castagnol and Paul Levy (Anonymous 1941), using the methods of Arrhenius, found in Indochina that former habitation sites now completely obliterated could be located on jungle covered laterite soils, as well as the trails leading to these sites.

Another case of where this type of soil testing might serve a purpose is in searching an Indian mound for burial. Rather than dig up the whole mound, especially if it were a linear mound, the archaeologist could use a soil auger and take samples from several depths along the mound, and perhaps locate the place of burial. In this type of search closer spacing than 5 feet would be better, since one might otherwise miss the place of burial because of limited lateral diffusion of phosphorus solutions. I once ran a test on some soil taken from an Indian

grave adjacent to a skeleton and it gave a very strong reaction for phosphorus.

Using soil tests in an Adena mound Solecki (1953: 389) states, "Positive evidence was found indicating that there were more burials in Natrium Mound than originally had been enumerated. The latter were based on skeletal evidence, some of which was exceedingly meager. Phosphate analysis, revealing very high concentrations of bone phosphate in apparently nonburial features, actually proved the usefulness of this check."

If the archaeologist suspected burials on a certain hill, and no surface traces were left of the burials, probing with a soil auger might bring up soil that tested so high in phosphorus that he would be justified in digging. Of the immense number of graves that were made by aboriginal Indians, only a relatively few have been discovered by accident or from visible evidence.

It would seem, from studies that have so far been made, that once dissolved phosphates have become fixed in the soil colloidal complex, further dissolution by rainwater is a very slow process. Just how many thousands of years these fixed phosphates will remain is difficult to say. It would be extremely interesting to make available phosphate tests on one of the eastern Paleo-Indian sites which was free from later contamination.

ANONYMOUS

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Rt. 2, Madison 5, Wisconsin
February, 1956

THE KHMER SETTLEMENT PATTERN: A POSSIBLE ANALOGY WITH THAT OF THE MAYA*

There has recently been increased attention paid to the nature of the settlement pattern of Classic Maya civilization. It now seems likely that Classic Maya "cities" were not secular, urban communities in which large numbers of people were grouped together in close proximity. On the other hand, if these were merely ceremonial centers in which the populace gathered for certain rituals, then the political and religious organization of these centers, and the actual socio-political structure of the entire Maya area, are as yet undetermined.

Archaeological reconstruction proceeds mainly by analogy. It may therefore be of interest to Mayanists to summarize what is now known of the settlement pattern of that other great tropical forest civilization, the Khmer Empire, which bears so many puzzling similarities to the Classic Maya. The Angkor, or Classic, period of the Khmer Empire lasted over 600 years, from A.D. 802 to 1431, during which the capital was at or near the site of Angkor itself. Although the Khmer development took place in a rain forest environment, it should be kept in mind that the economy, unlike that of the Maya, was based on intensive agriculture: the raising of wet rice in paddy lands irrigated from large artificial lakes and canals.

The investigations of the École Française d'Extrême Orient have clarified to a considerable extent the nature of Khmer "cities." A great deal of eyewitness information is also to be found in the report of Chou Ta-kuan, commercial attaché in the Chinese embassy which arrived at Angkor in 1296 (Pelliot 1951).

The ruler of the Khmer Empire was a priest-king, the intermediary between his royal ancestors and his realm. During his lifetime, he caused a great temple-mausoleum to be constructed; on death, his remains were entombed in this edifice, to which his successor came to worship his progenitor, now God-King. It is likely that most of the great Khmer monuments, including the enormous Angkor Wat, were in function both tombs *and* temples, for which Coedès (1947: 84) proposes the name "funerary temples." In other words, the bulk of the stone architecture visible at a site like Angkor consisted not of civil architecture but religious edifices, dedicated to the royal cult. These sacred cities were microcosms of the divine world: the central structure, with its characteristic 5 towers on a temple pyramid, represented the holy Mount Meru, the center of the universe; the surrounding walls were the rock wall which enclosed the universe; and the water-filled ditch bounding all was the great ocean. Regardless of whether the state religion happened to be a Siva cult or Mahayana Buddhism, the essential nature of Khmer cities remained unchanged.

The king and his entourage evidently did not reside in any of these imposing edifices, but in a palace of wood roofed with tiles. Chou Ta-kuan relates that the king had 1000 to 2000 servants and 3000 to 5000 girls and concubines (Briggs 1951: 245). The nobility lived within the city, and were also entitled to tile roofs. There was a sizeable group of merchants within the city walls, including some from foreign countries. In addition, each of the great temples had its own priests, retainers, and dancers.

According to Chou Ta-kuan, there were over 90 provincial capitals subject to the Angkor king; each had its own "mandarins" and each was surrounded by a wooden palisade. The great mass of the people lived in the villages; every village had its own temple. However, it is evident that many, if not most, villages were grouped together administratively as ecclesiastical properties belonging by frank-almoign to the great temples of the central capital and provincial centers. (Frank-almoign was a kind of spiritual tenure in feudal England whereby a religious corporation held lands in perpetuity. It is here proposed that this term be extended to include all socio-political systems in which religious centers are supported

* Gordon R. Willey and Sophie D. Coe gave me the benefit of their advice in this paper.

by the tenants and produce of ecclesiastical lands.) For instance, the temple of the Ta Prohm group at Angkor, consecrated in 1186, was granted by its charter 3140 villages for its support; the total number in its service thus was 79,365 persons. Prah Khan, another group at Angkor, was inaugurated in 1191 and had 5324 villages and a total of 97,840 persons available as food producers and corvée labor (Coedès 1951: 193-4). By 1191, there were 306,372 persons living in 13,500 villages devoted to the support of the Khmer temples and their cults — a figure that surely must have represented a large part of the Khmer population at that time.

The Classic Khmer settlement pattern, then, consisted of a large rural population scattered in villages throughout Cambodia, supporting ceremonial centers with rice and corvée labor. The Khmer "city" is not at all cognate with fully urban communities like Tenochtitlan, Mohenjo-Daro, Akkadian Uruk, or Rome; rather, it seems to have been a cult center supported by the produce and forced labor of the hinterland. Inside the city were the royal court, the nobility, the priesthood and temple retainers, and some merchants, but with the activity largely directed towards sacred, rather than secular, ends.

Perhaps the situation in the Maya area was not very different. Tikal could have been the major capital, with jurisdiction over provincial capitals like Uaxactún, Copan, and Palenque. In these "cities," the majority of the edifices were probably entirely ceremonial (including the so-called "palaces"), with the administrative hierarchy living in perishable structures. The bulk of the Maya population lived in villages, the distribution of which was based on the availability of arable land. Possibly these villages, as in the Khmer Empire, were organized into frank-almoign territories devoted to the support of temples in both the major capital (Tikal?) and in the provincial centers. In view of the fact that there seems to be no marked increase in the frequency of house mounds close to, and even within, Maya ceremonial centers, this may be a plausible explanation of the nature of the Maya "cities" and settlement pattern.

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December, 1955

PRE-COLUMBIAN WOOD-CUTTING TECHNIQUES

The problem of the technique whereby the Maya, Aztec, and other peoples accomplished the cutting of wood in the vast quantities needed for construction, and particularly for lime burning has long been a matter of speculation (Morris, Charlot, and Morris 1931). Wood cutting might have required comparatively little effort if metal tools had been available, but this was apparently not the case. Stone tools were at hand but, if one uses a stone axe in the orthodox manner, one finds that it is a very sorry implement indeed; the wood does not get cut, it merely crushes and the fibers are just as tough as before. Fire can, of course, be used. It will sever a tree trunk but it needs constant care, and any trimming, such as removing branches, is wholly out of the question. Despite these difficulties wooden beams were cut and shaped accurately and, as lime could not have been used in the immense amounts found if it were so tedious to cut the wood for burning, it seemed likely that a simple method of wood cutting must have been used.

With this in mind the author attempted to duplicate the Aztec war clubs that are reproduced in various paintings and tried one of these on wood as a saw rather than as an axe. Teeth of glass of equal length were made from strips of ordinary bottle glass. These were embedded in resin and clamped firmly between 2 slats of wood as in Figure 1. The strips were about ½ inch wide and were placed as closely together as possible making a toothed strip about 14 inches long with all the teeth protruding to the same straight edge. Needless to say, the teeth were all sharp. This assemblage was then used as a saw both against a tree and against a 2 by 4 inch pine board. Light pressure and a fairly swift motion were used and the tool seemed almost as satisfactory as the commercial steel bladed saw. There seemed to be little effort needed for cutting up to the depth of the teeth and the teeth did not appear to be unduly strained, nor did they get worn in the slightest.

This seemed a thoroughly practical method of wood cutting and it seems particularly plausible when one notices the similarity between the crude implement made by the author (Figure 1) and the drawings of obsidian bladed axes that are extant. Obsidian is a natural glass and the glass strip in the author's tool could be readily replaced by the obsidian flakes that have been discovered in so many places. It should perhaps be pointed out that several of the prehistoric eccentric obsidian and flint objects that have been found are ideally suited to use as saw teeth. The caches described by Ricketson (1937, Pls. 60, 61) might well refer to some of these saws that had utterly decayed except for the teeth that would then be left in an incoherent mass. They correspond in both size (about 7.5 cms. long and 1.5 cms. wide) and shape to the post facto and independently constructed ones fashioned by the author.

It might be argued that the cut could not have been made deeper than the blades of the saw. This is indeed the case, but it is easy to see how a groove can be cut to accommodate the wooden part of the blade by starting in at 2 points, one above the other, and knocking out the weakened wood in between. Trees can be girdled by a cut and progressively weakened.

The resin that might be used to fasten the blades is another point of interest. Copal gum is one of the very

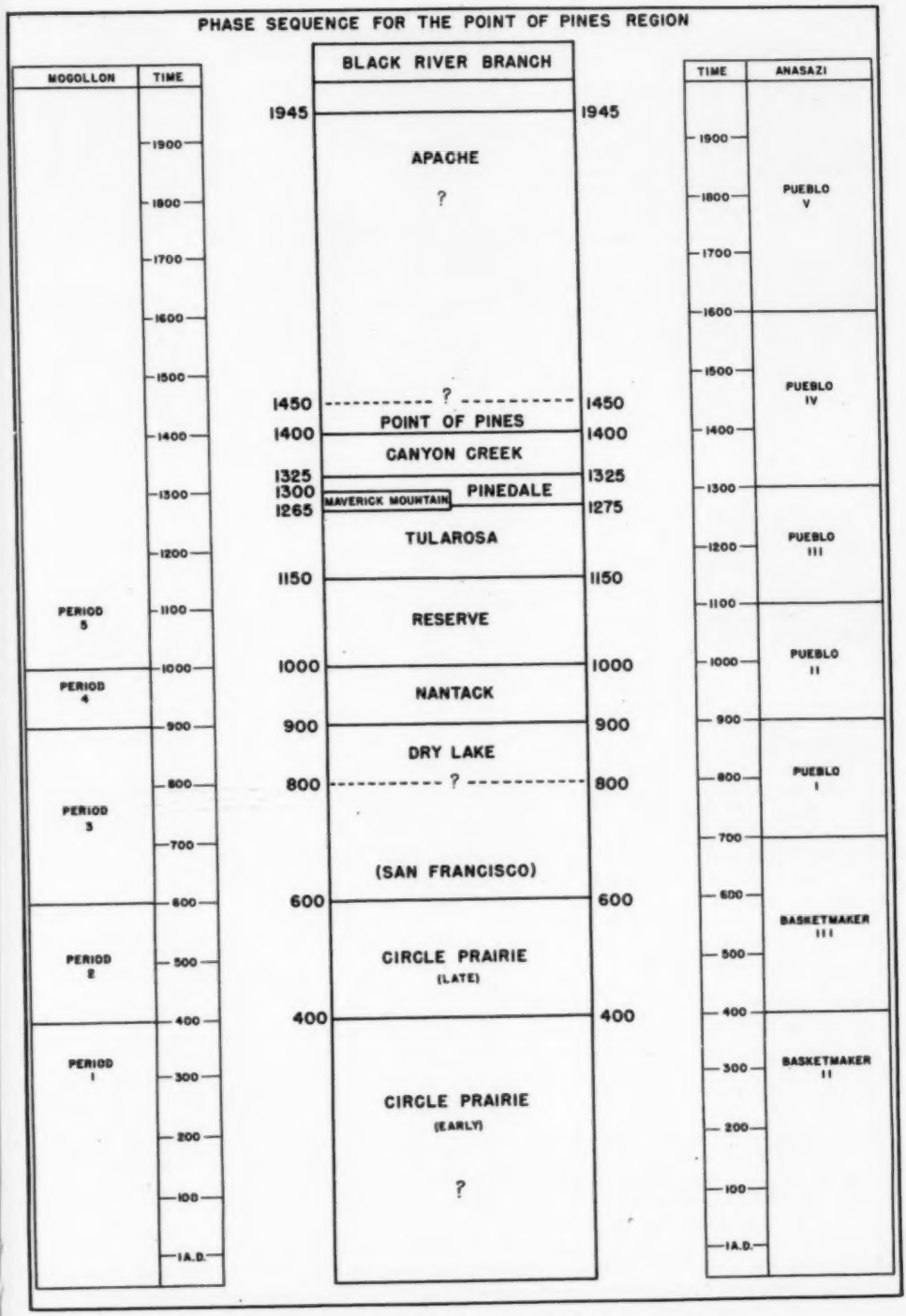

Fig. 1 [Breternitz, Gifford, and Olson]. Phase sequence for the Point of Pines region.

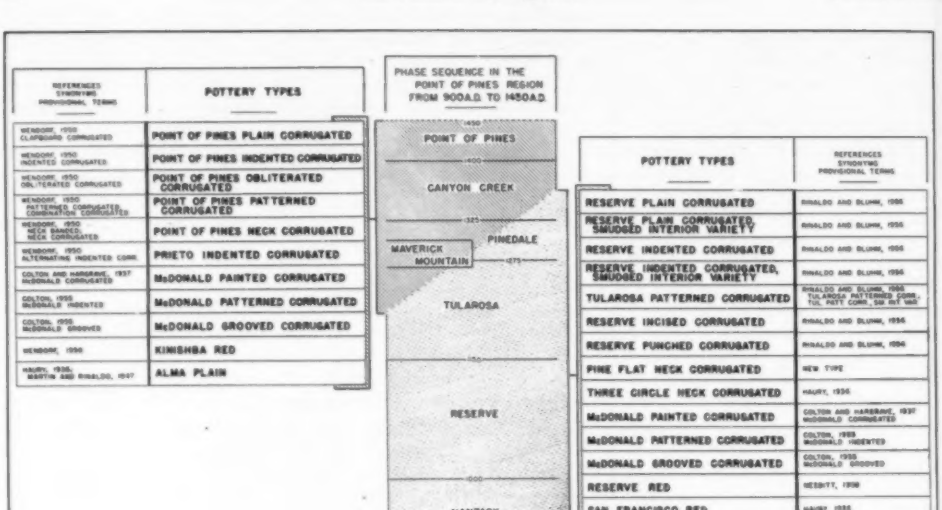

FIG. 2 [Breternitz, Gifford, and Olson]. The designation of primary utility pottery types and their relation to phases in the Point of Pines region from A.D. 900 to 1450.

sequence which has been adopted at the present stage and standardize the terminology used regarding utility pottery types from A.D. 900 to 1450.

In his works on Crooked Ridge Village and the Mogollon culture, Wheat gave the foundation from which the present phase sequence (Fig. 1) has been derived. Wheat's original system (1954b: 577, Fig. 1; 1955: 185, Fig. 12) and that used by Wasley (1952: 5) proceeded from A.D. 100, with Circle Prairie phases, through San Francisco, Three Circle, Reserve, Tularosa, Willow Creek, Pinedale, Canyon Creek, and Point of Pines phases, to 1450.

The picture as it pertains to phases and their temporal assignments has changed in the light of added evidence. Dry Lake and Nantack phases have been distinguished and substituted for late San Francisco and Three Circle phases; Willow Creek phase (Wendorf 1950: 145) has been deleted and is included in late Tularosa and early Pinedale phases. Maverick Mountain phase has been added and represents an intrusive element in the Point of Pines region from the Kayenta area of northeast Arizona.

Figure 2 indicates utility pottery type names which have been decided upon and are now in use, it suggests the relationship between types, and it notes general temporal values. By naming textured pottery types, such as Reserve Plain Corrugated, precedents were set by Rinaldo and Bluhm (1956) in their recent paper. Particular attention was given their scheme of corrugated pottery type names and for purposes of naming types found at Point of Pines the work of Martin and his associates in the Reserve area was followed as closely as possible. Textured pottery types are either the same or related in both areas and the taxonomic picture would be complicated and no purpose accomplished by attempting to use any different system of designation.

Certain names were proposed on a provisional basis by Wendorf (1950: 35-53) for corrugated pottery types made during the Point of Pines phase, 1400-1450. The fact that these are distinct types, as opposed to the textured pottery most popular during earlier phases from 900 to 1275, calls for their independent designation. On the other hand, affinities in surface manipulation and related details necessitate a certain consistency of terms to indicate this; Point of Pines Plain Corrugated and Reserve Plain Corrugated may serve as an example. The terms "Point of Pines" and "Reserve" set these two apart as separate types on temporal and areal grounds. The term "Plain Corrugated," used in both relates the two from the standpoint of techniques.

The chart (Fig. 2) suggests in diagrammatic form that as time advances the pottery types shown on the right side grade into those on the left. At either end of the time scale the types are distinct, and with the passing of time the popularity of those on the right diminishes while the popularity of those on the left increases. No attempt is made to give specific beginning and ending dates for each particular type. Only general temporal implications can be shown. The techniques of one group grade into that of the other. The trend forms a continuum. Early types before their complete eclipse overlap later types. Alma Plain, McDonald Painted Corrugated,

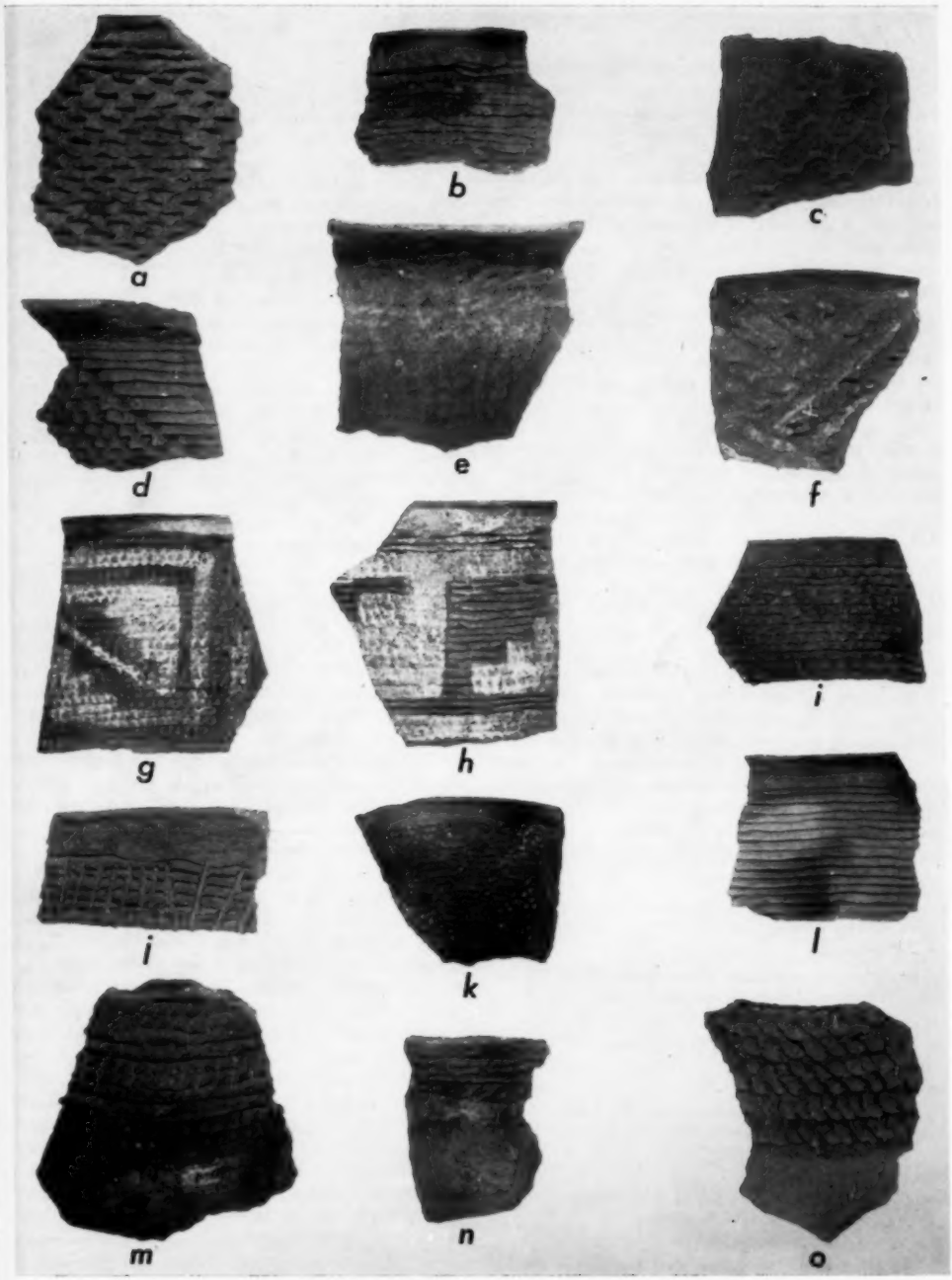

FIG. 3 [Breternitz, Gifford, and Olson]. Textured pottery types of the Point of Pines region. *a*, Point of Pines Indented Corrugated; *b*, Point of Pines Plain Corrugated; *c*, Prieto Indented Corrugated; *d*, Point of Pines Patterned Corrugated; *e*, Point of Pines Obliterated Corrugated; *f*, McDonald Grooved Corrugated; *g*, McDonald Painted Corrugated; *h*, McDonald Patterned Corrugated; *i*, Reserve Indented Corrugated; *j*, Reserve Incised Corrugated; *k*, Reserve Punched Corrugated; *l*, Reserve Plain Corrugated; *m*, Tularosa Patterned Corrugated; *n*, Three Circle Neck Corrugated; *o*, Pine Flat Neck Corrugated. Scale: *h*, width, 10.3 cm.

McDonald Patterned Corrugated, and McDonald Grooved Corrugated extend throughout the entire sequence and for this reason are listed in both right and left columns.

The name Three Circle Neck Corrugated (Haury 1936: 36-7) set a taxonomic standard, and where it became necessary to establish a new neck corrugated type, Pine Flat Neck Corrugated, this nomenclature was followed. A few types in the group on the right side of the chart will, of course, extend back in time earlier than the Nantack phase, A.D. 900; this is indicated by the jagged lower limit to the right. Utility pottery types which appear at Point of Pines prior to 900 are not considered because no Dry Lake phase site has as yet yielded ceramic material adequate for description and types for the Circle Prairie phases have been satisfactorily described by Wheat (1954a: 81-9).

The pottery types grouped on the right and assigned to earlier phases are of wide geographical distribution as opposed to a more local distribution for those of later times which are grouped on the left. Only the more abundant utility types are dealt with here and there is reason to believe that it may be necessary to expand this framework to include types which may emerge as a result of further field work.

A potsherd representing each of the textured pottery types discussed is illustrated (Fig. 3). It must be emphasized that potsherds alone give only a few of the details distinguishing these types. Due to limitations inherent in this paper, full descriptions of textured pottery types including such important criteria as vessel shape, size and wall thickness, and paste characteristics are not included. Starting points and terminal dates assigned the various types and how types act as hallmarks for specific phases are also among those problems which will be explored and presented in subsequent detailed reports concerning the Point of Pines archaeological research program.

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MOUND 2 AT MARKSVILLE *

The Marksville site lies about a mile to the east of the small town of that name, in Avoyelles Parish, Louisiana. Its earthworks, which were first described by Gerard Fowke (1928: 405-34), belong to several distinct components: the Nick site, the Greenhouse site, and the Marksville site proper (Ford 1951: 13-14). The latter component — the oldest of the three — consists of Fowke's "Enclosure A" (Fig. 1), a group of 5 mounds situated on the edge of a steep, eastward-facing bluff and enclosed on the west by a semicircular earthen rampart 4 to 7 feet high and more than half a mile long. Just to the south of this enclosure lies a circular embankment which may be of comparable age. Further south lies the Nick site (Fowke's "Mound 1") which is known to be younger than the structures of Enclosure A. The Greenhouse site, comprising Mounds 14-20, lies on the floodplain below the bluff, about a mile to the north of the enclosure. It, too, is younger than the Marksville site proper; it dates from the Troyville and Coles Creek periods. Half a dozen other mounds lie atop the bluff, overlooking the Greenhouse site. They may represent yet another component, but they have not thus far been adequately investigated.

Fowke excavated within Mound 4, a conical burial mound which lies in the west-central part of Enclosure A. In examining the grave goods recovered by Fowke, Frank M. Setzler (1933) recognized that the pottery bore a resemblance to that which had been obtained from Ohio Hopewell sites, and he decided to investigate the Marksville earthworks more fully, inasmuch as they seemed to

* This report is based upon fieldwork undertaken in 1939 as a part of the State-Wide Archeological Project of the Louisiana Works Progress Administration, sponsored by the Louisiana State University and directed by James Ford. The fieldwork itself was supervised by R. Stewart Neitzel, and the specimens were analyzed in the Project's New Orleans laboratory, under the supervision of Gordon R. Willey.

him to represent a Southeastern facies of the Hopewell culture. In 1933, with James A. Ford's assistance, Setzler (1934) excavated another part of Mound 4, tested Mound 6 and a midden to the east of Mound 2 (Fig. 1), and examined other parts of the site. He has not yet described the material thereby accumulated.

Ford (1936: 226-31) has dated the Marksville site by means of a surface sample of 135 decorated sherds which he obtained from the neighborhood of Mound 2. The deposits surrounding Mound 2 appeared to Ford to be the richest in the whole of Enclosure A, and he resolved to see that they were tested in a more thorough manner on some future occasion. Such an occasion arose in 1939, when R. S. Neitzel, who was excavating at the Greenhouse site, was forced to discontinue his work because of a flood. Moving atop the bluff, he undertook the excavations which I shall describe. Though he incidentally discovered some intriguing architectural features, Neitzel was chiefly interested in obtaining sherd samples which would afford information on the relative age of the mound, for although Setzler and Fowke had shed a good deal of light on the burial complex, sound chronological data were lacking.

Mound 2 lies in the south-central part of Enclosure A. It is about 14 feet high, and Fowke (1928: 413-4) has recorded its dimensions as 290 feet on a line running N70°W and 235 feet on a line running N20°E. It is misshapen. Indeed, it is so broken down that Fowke originally entertained some doubt as to its artificiality; he eventually concluded, however, that it actually was a structure and that its deterioration was attributable to the instability of one of its component soils, a clay which tends to creep when wet. But notwithstanding the fact that it is deformed, there can be little doubt that Mound 2 represents a quadrilateral or ovate platform. As such, it contrasts with the neighboring mounds, which are of conical shape. Ford and Neitzel surmised that the structure might be a temple mound, whereas the others are known to be burial mounds. If such were, in fact, the case, the richest deposits of cultural remains — refuse from buildings situated atop the platform — would occur along the structure's flanks rather than within it. Neitzel therefore dug trenches on 3 sides of the mound (Fig. 1); little surface material was found along the platform's northern flank, hence no trench was dug there.

In Trench A 4 strata were distinguishable. The silty humus, 3 to 5 inches thick, was underlain by a stratum of mottled or bleached silt, which ranged in thickness from 15 to 18 inches. Underneath this silt lay a stratum of gray clay-loam, about 2½ feet thick, and this soil was in turn underlain by a gray clay, which extended downward to a depth of at least 6 feet. Most of the cultural remains were found within the silt; the clay was sterile, and the clay-loam nearly so. Postmolds were sometimes

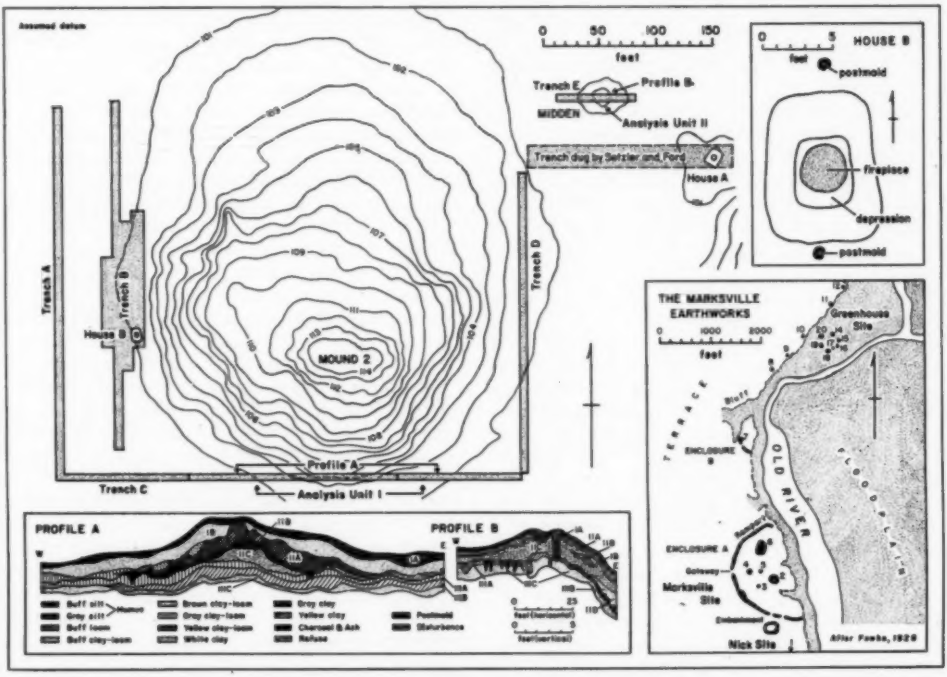

FIG. 1 [Vescelius]. Marksville, Mound 2, plan and profiles.

encountered within the upper portion of the latter stratum, but no post patterns could be made out.

Artifacts were more abundant within Trench B—which lay 50 feet to the east of Trench A, nearer the edge of the mound—and postmolds were also more common. In a few instances Neitzel was able to discern linear post patterns. Vestiges of a wall corner and a fireplace were found in one part of the trench, but the wall could be traced for no appreciable distance. Neitzel also discovered 2 aboriginal wall trenches, which ran parallel to one another and which lay about 4 feet apart. He was able to trace one for about 40 feet, and the other for about half that distance. Both were about 4 inches wide, and posts had been set within them at 9 inch intervals. It could not be determined whether they represented the walls of a single structure or those of 2 adjacent buildings, for they were shallow and, inasmuch as the site has been repeatedly ploughed, they had been partially obliterated.

While excavating Trench B, Neitzel unearthed a small, debris-filled rectangular pit house (House B) about 10 feet long and 8 feet wide (Fig. 1). Its uneven floor, the center of which was occupied by a basinal fireplace, was intact, for it lay beneath the plough zone. Apparently, however, the uppermost part of the house's sloping walls had been obliterated. The structure itself cannot be dated with assurance, but the fact that it was filled with soil and refuse which had been washed down from the mound strongly suggests that it is of about the same age as the larger structure; part of a Marksville Plain pot was found just above its floor. House B is an intriguing feature, for with the exception of a nearby pit (House A) excavated by Ford in 1933, its like is unknown in the Southeast. House A seems to have been somewhat better preserved; it was lined on 2 sides with posts. I suspect that the same was once true of House B, but that the postmolds have largely been destroyed in the course of cultivation. Only 2 vestigial postmolds could be found within the area near the pit; one of these lay just to its south and the other lay about 2 feet to its north.

The stratigraphy of Trenches B and D was comparable to that of Trench A, though some variation in soil color and texture was, of course, noted. A somewhat more complex situation obtained, however, within the middle part of Trench C, which cut through a corner of the mound itself (Fig. 1). Between the recent topsoil (Strata IA-IB) and the gray clay-loam subsoil (Stratum IIIA) of Trench C (Fig. 1, Profile A) lay 3 distinct convexo-concave lenticular strata, each of which seems to represent one of the mound's mantles. The lowest of these was a yellow clay (Stratum IIC); it was overlain, successively, by a gray clay (Stratum IIB) and a yellow clay-loam (Stratum IIA). Hearths, represented by depressions filled with charcoal and ash, were found at either side of the mound, near what must once have been the points of convergence of these lenticular strata.

The midden which lies to the northeast of the mound (Fig. 1, Profile B) rests upon a sterile layer of buff clay-loam (Stratum IIIA) and dark humus-like soil (Stratum IIIB). Neitzel found a number of ostensible postmolds, as well as some rodent burrows, within Stratum IIIA, and he also encountered some redeposited brown clay-loam (Stratum IID), which may have been thrown out during the construction of a building; but no walls could be traced. The midden itself is divisible into 2 strata which are partly separated by a lens of mottled buff clay-loam (Stratum IIB); the upper deposit (Stratum IIA) is grayish black in color, whereas the lower zone (Stratum IIC) is dark brown. Two postmolds were found on the level of Stratum IIB. The artifacts from the various parts of the midden were not found to differ significantly from one another (Table 3); thus, the material seems to have been deposited rapidly, over a short period of time.

A circular pit house about 65 feet in diameter, superficially visible as a depression ringed by an earthen embankment, lies about 350 feet to the southeast of the mound. Neitzel excavated within this house, but he found it to be rather featureless: its walls and its floor were poorly defined; no postmolds, other than a few shallow, intrusive ones, could be found, nor could a fireplace be discovered. Among a number of sherds found in the fill was the rim of a Yokena Incised pot, the remainder of which had been ploughed away. It is, of course, quite possible that the house is considerably older than this sherd, yet I tentatively suggest, on the basis of this single bit of evidence, that the structure dates from late Marksville or Troyville times.

By means of his excavations in the neighborhood of Mound 2, Neitzel collected 6640 potsherds. Of these, 3623 do not, in a rigorous sense, afford thoroughly reliable seriation statistics, inasmuch as they come from unprofiled trenches, from greatly disturbed deposits, or from zones of considerable stratigraphic complexity. The remainder, those which come from relatively undisturbed and uncomplicated areas, profiles of which have been drawn, comprise 2 collections, Analysis Units I and II. Analysis Unit I (Table 2) represents the west-central and eastern portions of Trench C (Fig. 1), and Analysis Unit II (Table 3) represents Trench E. Type proportions, expressed as percentages, have been computed for the samples from each 3-inch level of each of these trench sections; the samples from the 2 uppermost levels, which represent the plough zone, have been consolidated. Proportions have also been computed for the whole collection (Table 1).

The various sherd samples do not differ appreciably in composition, either from level to level or from unit to unit. In all cases, more than three-quarters of the sherds are of the type Marksville Plain (Ford and Willey 1940: 59-65). Most of the remaining sherds belong to other Marksville types (Ford and Willey 1940: 65-85); sherds of the Stamped, Incised, and Rim Incised types are rather common, and a Red Filmed sherd was found in Level D of Trench E (Table 3). Crooks Stamped (Ford and Willey 1940: 81-2), earliest of the Marksville period types, appears frequently in small proportions. A few specimens of types which are characteristic of the

TABLE 1. TYPE PERCENTAGES IN THE SHERD COLLECTIONS

Trench	*A*	*B*	*C*	*D*	*E*	*Whole*
Catahoula Incised	0.4	0.1				Trace
Chevalier Stamped				0.1		Trace
Beldeau Incised				0.1	0.1	Trace
Churupa Punctated			0.1			Trace
Mulberry Creek CM*		1.2	0.1	0.3	0.3	0.4
French Fork Incised				0.1		Trace
Troyville Plain			0.2	5.5	2.4	2.1
Troyville Stamped			0.1	0.1	0.3	0.1
Marksville Plain	96.1	87.5	84.0	78.1	82.5	83.0
Marksville Stamped	0.4	5.3	9.5	9.2	8.7	8.1
Marksville Incised	3.1	4.7	3.0	4.1	4.5	4.3
Marksville RI*		1.1	2.7	1.9	0.8	1.7
Marksville RF*				0.2	0.1	0.1
Crooks Stamped		0.1	0.4	0.3	0.1	0.2
Number of Sherds	225	1208	2175	1925	1107	6640

* RI = Rim Incised, RF = Red Filmed, CM = Cordmarked.

later Troyville and Coles Creek periods, were also recovered: Mulberry Creek Cordmarked (Ford 1951: 53-7), Troyville Plain (Ford 1951: 67-8), and Troyville Stamped (Ford, 1951: 49-50). A Beldeau Incised sherd (Ford and Willey 1940: 85-6), which may be intrusive, was found in Level C of Trench E. A few types not represented in the analysis units occur within the remaining samples (Table 1). These are French Fork Incised (Ford 1951: 62-7), a late Troyville type; Catahoula Incised, a Mississippian form; Chevalier Stamped (Ford and Willey 1939: 4-5), a Coles Creek period type; and Churupa Punctated, a Troyville period ware. In addition, it should once again be noted that a pot of the Troyville type Yokena Incised (Ford 1951: 50-2) was found in the circular pit house to the southeast of the mound.

TABLE 2. TYPE PERCENTAGES IN ANALYSIS UNIT I, TRENCH C

Level	*A-B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Mulberry Creek CM		0.3	0.3	0.3					
Troyville Plain	0.2								
Marksville Plain	84.1	77.8	82.2	84.3	83.8	79.7	90.9	90.5	100.0
Marksville Stamped	9.2	12.8	12.1	10.0	8.3	10.8	5.5	4.8	
Marksville Incised	3.5	5.1	2.4	3.4	4.4	5.4		4.8	
Marksville RI	2.9	3.4	2.7	1.6	3.2	3.6			
Crooks Stamped		0.6	0.3	0.3	0.6	0.9	3.6		
Number of Sherds	408	296	330	320	349	111	55	21	8

In plotting the frequencies of sherds found within the various 10-foot sections of Trench C, I found that the density of sherds varied inversely with distance from the mound. Similarly, sherds were more commonly encountered in Trench B than in Trench A, which lay further from the mound. These findings serve to corroborate the hypothesis that most of the specimens which Neitzel found derive from the mound.

One hundred and twelve stone artifacts were recovered, and of these twenty-nine were classified as projectile points, according to a scheme which has been described in the reports on the Greenhouse site (Ford 1951: 114-5) and the Crooks Mound (Ford and Willey 1940: 93-102). I propose, however, to emulate Ford (1951: 115-9) and Krieger (Newell and Krieger 1949: 161-73) by adopting Kelley's binomial system of projectile point nomenclature. Of the specimens found by Nietzel, twenty-five (86.2%) are stemmed "dart" points, whereas the remaining four (13.8%) are "arrow" points of the type Alba Barbed. The most popular type is Gary Stemmed, represented by 22 specimens, which comprise 75.9% of the sample. Three points of the type Ellis Stemmed were found, and, as I have said; four of the type Alba Barbed. The occurrence of the stemmed points is not unexpected, inasmuch as they are commonly encountered in Middle Woodland sites. That of Alba Barbed is, however, of special interest, for it would seem to represent one of the earliest known instances of the occurrence of "arrow" points in the Southeast. Neitzel also found 10 crude scrapers, all of which are ovate or ovate-triangular in shape and more or less lenticular in cross section; and half a dozen drills, four of which have expanded bases. Three hammers, a plummet, a core reject, 18 projectile rejects, and 55 flakes, few of which have been worked, comprise the remainder of the sample.

The Marksville site lies atop a bluff (Fig. 1) which marks the eastern edge of the Avoyelles Prairie, an isolated component of the Prairie Terrace. From the base of this bluff the dissected alluvial plain of the Mississippi stretches away to the eastward. Old River, which lies at the foot of the bluff, is a slit-filled meander which Fisk considers to be a segment of the Mississippi's Stage 3 channel. The bluffs were ostensibly carved by the river during this stage, which occurred, according to Fisk (1944: 42), about A.D. 300. The plan of the Marksville site is such as to suggest that the structures of Enclosure A were erected after the formation of the bluff, hence the remains which I have discussed would seem to date from no earlier a period than the third century A.D.

Summary. Excavations made in the neighborhood of Mound 2 at the Marksville site suggest that the mound itself was a rectangular or ovate platform erected during Burial Mound II — or Marksville — times. The majority of the sherds found along the flanks of the mound are of Marksville period type, and their distribution is such as to warrant the conclusion that most of them were washed down from the platform. The structure thus appears to be one of the earliest temple mounds in the Southeast, and, indeed, in the whole of the eastern United States. These appearances must, however, be verified; the mound itself should be excavated, in order to secure more concrete evidence of its structure and its relative age.

The small midden which lies to the northeast of the mound is of comparable age; the sherd sample from this

TABLE 3. TYPE PERCENTAGES IN ANALYSIS UNIT II, TRENCH E

Level	*A-B*	*C*	*D*	*E*	*F*	*G*	*H*
Beldeau Incised		0.3					
Mulberry Creek CM		0.6	0.3				
Troyville Plain		1.7	3.7	5.2			
Troyville Stamped		0.6	0.3				
Marksville Plain	85.7	84.8	77.4	81.1	81.2	92.3	93.7
Marksville Stamped	8.3	6.6	9.4	9.2	12.2	7.7	6.3
Marksville Incised	5.4	5.2	7.0	3.9	4.5		
Marksville RI	0.6	0.3	1.5	0.7	1.1		
Marksville RF			0.3				
Crooks Stamped					1.1		
Number of Sherds	168	349	358	155	90	13	16

midden differs to no appreciable degree from those obtained from within the mound detritus. The circular house to the southeast of the mound cannot be dated with certainty; however, it may tentatively be assigned to the late Marksville or Troyville period. The unusual rectangular house which lies just to the west of the mound would seem to be of about the same age as the platform itself, judging by the fact that it is filled with wash from that structure. The problem of the genesis of this house type, found at no other Southeastern site, is one deserving of attention.

Of the small sample of projectile points, the majority are stemmed "dart" points; the occurrence of a few barbed "arrow" points serves to suggest, however, that the sample dates from a time at which the bow and arrow had begun to replace the dart-thrower.

Mound 2 is an intriguing anomaly — a temple mound which gives every evidence of having been erected early in Burial Mound II times. It is to be hoped, therefore, that the problem of its character and age will soon be more thoroughly investigated.

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COASTAL NEW YORK AND CONNECTICUT PREHISTORY REINTERPRETED

Laboratory and library research, undertaken in the course of preparing a report on the Manakaway site of the East River aspect, Greenwich, Connecticut, have caused me to entertain doubts about some of the interpretations and divisions set forth by Smith in his *Archaeology of Coastal New York* (1950). This paper will air these doubts in the hope of soliciting comment and of stimulating interest in the unworked areas of this region, so that workers in the future will have more accurate data on which to build their conclusions.

The main point of difficulty is the exact nature of the East River aspect. Defined by Smith (1950: 116-29) and stated by him to have originated in New Jersey (1950: 109), this aspect is thought to have intruded into coastal region over the Clearview focus at a date of about A.D. 700 (Smith 1955: 4-5). This intrusion is identified as an actual population movement involving a group of tribes ancestral to the Wappinger, Metoac, and Lenape of Staten Island (Smith 1950: 108).

However, it is also possible that the arrival of East River represents in the main only the arrival of a constellation of ceramic traits, differing from those previously noted in the area. Resorting to a population movement to explain this appearance may be unnecessary since the conditions for diffusion (but from an area other than New Jersey) are ideal and evidence for it is present.

By conditions for diffusion, I refer to the geographical and cultural situation of the region. This area is peripheral to one of the largest waterways in the east, the Hudson. Further west are more waterways and streams. Waterways are generally main arteries of aboriginal trade and travel and it appears that the Hudson and Delaware and the lesser waterways of upper New York would have made excellent routes of diffusion southward from cultural centers in that area.

It is probable that this diffusion took place predominantly southward to the coast, rather than northward, since the greater cultural elaboration of New York even in Middlesex and Point Peninsula times seems to insure the culturally dominant role of the cultures of the upper part of that state over their eastern neighbors, who even at contact times were in a cultural backwater when compared with surrounding areas (Flannery 1939).

Evidence of diffusion is abundant in both Windsor and East River pottery types. In the East River aspect, East River Cordmarked is related by Smith (1950: 193) to Vinette I of New York; Bowmans Brook Stamped is related to the Owasco aspect pottery, probably the Canandaigua types (Smith 1950: 192), and Van Cortlandt Stamped is related to the Castle Creek types (Smith 1950: 191), as is Clasons Point Stamped. The later East River Incised type is affiliated with Iroquois wares (Smith 1950: 190). It seems then that Smith saw the similarities of almost every type of East River ware to New York types, but still felt it necessary to postulate a migration to bring East River from *New Jersey* overland to the coast.

This may have been done to account for the occurrence of similar pottery in the Rosenkrans Ferry site on the Delaware (Cross 1941: 132-43). This site is on a main waterway draining New York state and there is no reason to suspect that at the time of the Owasco flowering in New York, similar reflections would not begin showing up at spots closeley connected to the area of main development. Ritchie (1944: 28) shows very clearly how the Owasco cultural spread followed the main rivers both north and south. Cross (1941: 143) seems to feel that the Rosenkrans site is rather late, and I suspect that it is a little too late to be ancestral to East River, since the majority of pottery there is incised, a trait which does not appear until relatively late in the East River sequence. Also, affiliations to the Iroquois aspect are indicated.

MacNeish (1952: 55), on the basis of more recent work at Overpeck and Abbotts Farm, seems to feel that south central New Jersey is the point of origin of East River, but the pottery similarities which he cites could just as well indicate a parallel development from a common ancestral source, if we accept the possibility of diffusion from New York state along waterways.

Windsor's affiliations with New York developments are also numerous, relations being to Point Peninsula and the Vinette types in 6 out of the 12 types isolated by Smith, and to East River types in 2 instances (Smith 1950: 193-7).

Considering all the evidence of diffusion from New York centers to the coast, in all foci of the Windsor aspect up to East River and in all East River and Windsor foci thereafter, it would seem that a more acceptable explanation of the nature of East River would be that it is a coastal variation of Owasco traits, passed down to the coast just as all previous influences were passed along the major waterways of New York and New Jersey. In this form it is no more than one would expect to find following the earlier manifestations on the coast, and needs no migration theory to explain its appearance.

The result of the arrival of these traits was a development on the coast paralleling upper New York in its main outlines. The strength of these diffusions faded as they spread out eastward from the avenues of invasion, allowing some later regional developments in eastern Connecticut to follow their own lines. However, there are still Owascoid features in Niantic and Sebonac Stamped pottery, some examples of which are identical to East River types of the coeval Bowmans Brook, Clasons Point, and Fort Massepequa foci. Smith (1950: 193) derives Clasons Point Stamped from the Sebonac type but since they are coeval it does not seem to the writer that either could be derived from the other, but that they are the similar results of diffusion from a like source. This seems especially true in view of Massachusetts evidence of Owasco penetration. A number of Owascoid sherds appeared at the Guida Farm site in Westerfield (Rouse 1947: 17), and Fowler (1946: 1-5) points out the presence of strong New York influences in the Westerfield and Connecticut Valleys, especially in Owasco times. The M-41-22 site (Sherman 1947: 26-32) produced Clasons Point (Owascoid) sherds, which is surprising in the neighborhood of Plymouth. These are good indications of how strong the influences from New York were in late prehistoric times.

The differences that have been used to set apart the East River and Windsor wares are in paste, thickness, and interior surface treatment (Rouse 1947: 50; Smith 1950), but are these sufficient for the establishment of 2 different aspects when shape, decorative treatment, design, and exterior surface treatment show close similarities and evidence of diffusion is present to account for these similarities?

In conclusion, Windsor and East River seem to be 2 intergrading regional variations of the same cultural sequence, affected and differentiated only as to relative proximity to main avenues of diffusion. This movement out of New York State may have been in some way associated with pressure of the arriving ancestral-Iroquois. The relationship between Owasco and its successor are by no means certain. Some Owasco traits are found in the Point Peninsula focus but there are also traits which reappear in the later Iroquois, and Ritchie (1944: 56) can only state, after presenting the similarities between the various aspects, that there probably exists a broad relationship between Owasco, Iroquois, and Monongahela. The Windsor and East River aspects I do not find to be sufficiently separable in the Long Island Sound area other than by time levels, and the occurrence of Windsor sherds on East River sites may not be diagnostic of 2 occupations, but merely of a continuation of older types into later times, with a little modification.

There is no attempt here to lump for lumping's sake, but the writer feels that a perhaps undue amount of splitting has clouded the situation in the coastal area and that a reworking of material might be in order, with a view to discerning more basic similarities and differences. Also, in an area in which so little really scientific work has been done, a healthy scepticism is wise until much more excavation provides a basis against which to revise or reaffirm the existing scheme.

One final point of an entirely different nature might be mentioned, namely, the applicability of the McKern system. I have become increasingly convinced that there is no justification for the splitting and grouping that is necessary if all data are to be assigned to foci and aspects. That the system is misused here is obvious — it has been invested with temporal overtones that it is inadequate to express. It will be proved again and again that the system is unsuitable as more sites are dug in areas which were not reported when Smith's study was in progress. As it has proved to be impossible to fit the Manakaway site into the scheme without drastic forcing, so it will with other sites, and it will be seen that the system, built on work in a few limited areas, is only suitable for those areas, and that attempts at extension immediately cause difficulties.

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A BIRDSTONE FRAGMENT FROM NEW YORK CITY

A few weeks prior to the bulldozing of a segment of the Schurz site (Lopez 1955), in the southeast corner of the Bronx, within the city limits of New York, a salvage dig was conducted by Harry Trowbridge, George Younkheere, Stanley Wisniewski, Theodore Kazimiroff, and Wayne Arnold under the writer's direction.

One of the items found was a polished birdstone fragment (Fig. 1) which deserves special mention since so few effigies of this sort have been discovered hereabouts. It was found by Younkheere at the bottom of a shell layer (at minus 10½ inches) in a quadrant adjacent to a postmold pattern which was oval in shape with intersecting diameters measuring 8 by 4 feet. Lamentably, there were no features within, or immediately outside, the enclosure, and no stratigraphic value could be attached to any of the artifacts from the overburden because the black earth and shells had obviously been plowed.

As a sculptured form, the birdstone is the most elaborate stonework to come from the site. While it is not the best looking artifact of its kind, considerable care had been devoted to the blocking out of the stone to leave room for the protruding eyes which have an "X" incised over each. There is another such mark on the back of the head. The "bird," as will be noted, lacks a beak. This gives it an odd, if not a somewhat freakish profile. It may be that it once possessed a beak and that it broke. The head, consequently, might very well have been repaired though there is nothing to indicate it. The present length is 2⅛ inches.

The stone is an unbanded, reddish brown slate. The underside of the head, and the throat as well, are flat while the upper contour is arch shaped in cross section with a more pronounced tapering along the crown. Numerous cuts and scratches surround the eyes as a result of the shaping. Curiously, there is a series of very fine parallel incisions, which must have been cut with a very sharp tool, across the back of the neck. These may, or may not, be tallymarks. Indeed, it is difficult to explain these scorings, especially, since they are almost precisely spaced about 1 mm. apart. The broken end is jagged from the fracturing of the stone and shows the laminated structure of the slate, which is not apparent otherwise because of the high degree of polish.

At least 4 attempts had been made to drill the stone. One was started, but soon abandoned, some distance up from the base of the throat. The artisan evidently misjudged the place where the perforation should be begun. The other 3 tries were aimed from different directions (two from the top of the neck, and one from the bird's left side) apparently with the idea of having at least 2 holes meet at an angle near the center of the stone. Whether or not the worker succeeded is disguised by the irregular fracture. It looks, however, as though the stone broke as a result of the ambitious undertaking. The many attempts at countersinking might well have split the slate, particularly since they were confined to a small area on the neck, which, to begin with, is rather slender.

The occurrence of birdstones is concentrated in the Ohio Valley and around the Great Lakes. However, they are also quite common throughout a much larger area between the Mississippi River and the Appalachian Mountains, and from the Great Lakes southward through Kentucky and Tennessee (Moorehead 1917, Fig. 204). They are rare along the Atlantic Coastal Plain and in the states bordering the Gulf of Mexico.

According to Alanson Skinner (1919: 28) birdstones have been found in New Jersey and in Connecticut, but are exceedingly rare. This also holds true of this general coastal corner which previously produced an isolated surface find, made of steatite, from Ardsley, Westchester County, New York (Skinner 1920: 182, Fig. 4). At the northern tip of Manhattan Island another object was found in a shell heap near Spuyten Duyvil Creek. Skinner described it as probably the remnant of a slate bird or bar amulet. One end had "the characteristic boring from two sides at right angles to each other," but the other end was headless.

FIG. 1 [Lopez]. Birdstone fragment (3 views) from Schurz site, New York City. (Length, 2⅛ inches.)

In central New York State many birdstones have been collected and are affiliated with the early ceramic horizons of Middlesex and the Point Peninsula foci of the Vine Valley aspect (Ritchie 1944: 115, 117, 370). The range of conventionalized types cover: (1) those with a slightly raised head, a broad ridged base, and an expanded tail; (2) objects consisting of only the head and shoulders of the bird mounted on a flat, disclike platform; and (3) a narrow bar form which is comparatively rare (Parker 1917: 196). Plain-faced specimens are more common than those with protruding, or knobbed eyes, but all have bills. Most were made from an attractively banded slate, such as the striped Huronian variety. A few, however, are of sandstone, granite, limestone, or other materials, usually with mottled colors.

From the foregoing it is clear that our example is somewhat different. However, it is no doubt related to the birdstones found upstate, and to such complexes as Glacial Kame and Late Adena (Solecki 1953: 357, 379). In the absence of any clearly defined Point Peninsula and Middlesex manifestations in the Greater New York City vicinity, it seems reasonable to attribute our zoomorphic item to the North Beach focus, Windsor aspect, the earliest ceramic assemblage present at the Schurz site. There are no carbon dates for this horizon. However, the consensus of opinion is that it was approximately coeval with the Vinette 1 components of the Vine Valley aspect.

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JULIUS LOPEZ
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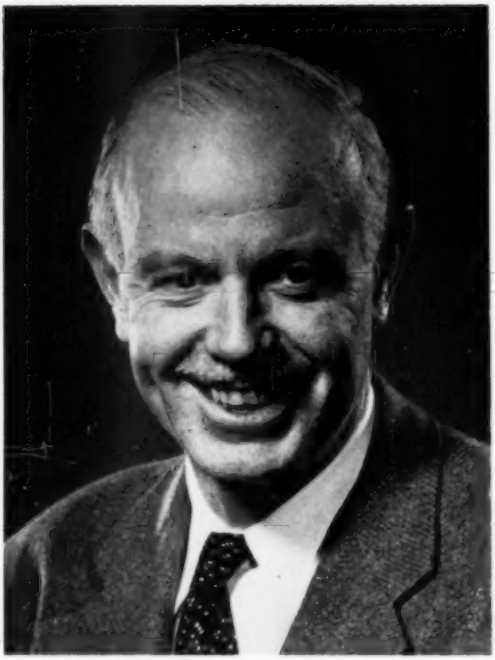
October, 1956



1956 VIKING FUND MEDALIST

ARCHAEOLOGY

CHOSEN BY

THE SOCIETY FOR AMERICAN ARCHAEOLOGY

JUNIUS BOUTON BIRD

One of the outstanding archaeologists of the Americas, Bird has ranged from Greenland to Tierra del Fuego in his field trips for the American Museum of Natural history, where he is Associate Curator of Archaeology. Almost annually since 1927 he has engaged in excavations or explorations: Baffin Island, 1927; Bering Straits, 1928; in the Susquehanna and Juniata valleys while an archaeologist with the Pennsylvania State Museum, 1929; with R. A. ("Bob") Bartlett to East Greenland, 1930; Yucatan and Honduras, 1931; Cape York, Greenland, 1932; Tierra del Fuego, 1932-33; Southampton Island and Melville Peninsula, 1933; Labrador, 1934; Patagonia and Tierra del Fuego, 1934-37; Alberta and Saskatchewan, 1938; South Dakota Badlands, 1940; northern Chile, 1941-42; northern Peru, 1946-47; and Poverty Point, Louisiana, 1950. Bird's outstanding contributions to the study of the preceramic cultures of western and southern South America and in the technology and chronology of Peruvian textiles are matched by the enthusiastic encouragement he has given many beginners in archaeology and the generous way he constantly makes available his expert knowledge in a variety of technical fields.

PREVIOUS VIKING MEDALISTS IN ARCHAEOLOGY

ALFRED VINCENT KIDDER, 1946
JOHN OTIS BREW, 1947
ALEX DONNY KRIEGER, 1948
HALLAM LEONARD MOVIUS, JR., 1949
EMIL WALTER HAURY, 1950
FRANK HAROLD HANNA ROBERTS, JR., 1951
ALFONSO CASO, 1952
GORDON RANDOLPH WILLEY, 1953
WILLIAM DUNCAN STRONG, 1954
J. ERIC S. THOMPSON, 1955

REVIEWS

EDITED BY RAYMOND H. THOMPSON

Beginning in Archaeology. KATHLEEN M. KENYON. Sections on American Archaeology by Saul S. and Gladys D. Weinberg. Revised edition, Phoenix House and Frederick A. Praeger, London and New York, 1953. 217 pp., frontis., 14 figs., 11 pls. $4.00.

Down to Earth. ROBIN PLACE. Rockliff and Philosophical Library, London and New York, 1954. 173 pp., 88 illus. $7.50.

Still Digging. SIR MORTIMER WHEELER. Dutton, New York, 1956. 236 pp., 15 pls. $4.00.

The 3 books under review have in common the fact that they were written by British archaeologists. *Still Digging* by Sir Mortimer Wheeler is an autobiography, and as such must be considered apart. The other two are closer to Wheeler's *Archaeology from the Earth* (reviewed by Raymond Thompson, 1955, *Am. Antiq.*, Vol. 21, No. 2, pp. 188-9).

With a few slight exceptions they present little new information in the way of technique, and since the field experience of the authors has been almost entirely in Great Britain, the Near East, and India, certain problems characteristic of American archaeology do not appear. They are written for a British audience and are primarily adapted to the British archaeological scene with the addition, in Kenyon's book, of a few pages by Gladys and Saul Weinberg listing educational and professional opportunities in the United States.

Since none of these books is written for the trained archaeologist, this review will concentrate mainly on their value to the student, the beginner, and the amateur, with particular reference to the professional archaeologists who teach them, either in the classroom or in the field.

All 3 authors argue strongly for competent excavation and for the careful recording of data. On the other hand, it seems to this reviewer that such attention as is given to interpretation is limited to certain narrow aspects of given sites, and that the general theoretical principles underlying the comparative and interpretive uses of the data so painstaking gathered in the field are skimped. This orientation makes excellent sense if the primary purpose is to make the activities of amateurs more useful by encouraging them to feed more complete data along with specimens into competent hands or to introduce potential volunteers to certain field methods without reference to methodology. While these books may help channel local enthusiasts into more careful work, their message is blurred. The "how" is stressed at the expense of the "why," and for the serious beginning student this creates shortcomings which must be supplemented if the picture of archaeological research is to appear in its entirety.

In her *Beginning in Archaeology* Kenyon, who is recognized as a topflight excavator, states frankly that she is setting down what she wants the untrained people who come to work with her to know. Thus her sections on field work deal mostly with her own procedures. Although acknowledging that other excavators may prefer different ways of doing things, she pays little attention to alternative methods or their validity. Her writing has a curious abstract quality even though she deals with specific techniques.

In her first 2 chapters she attempts to set archaeological fieldwork into a broader context. Of these "The Meaning of Archaeology" is very sketchy, while "The Framework of Archaeology" consists of a 9-page culture history which is limited to the Near East, Egypt, and Europe with no reference to the rest of the Old World or to any part of the New. Her third and fourth chapters are addressed to the beginning student. "Fields of Archaeology" is divided into brief sections which focus primarily on those fields in which British archaeologists have been active. Although a few comments in "How to Become an Archaeologist" may be more broadly applicable, this chapter is very much tailored to the situation in Great Britain.

The last 4 chapters cover excavating, recording, dealing with finds, and field surveys and air photography. The various sections on excavation technique deal briefly with general principles and with the excavation of masonry buildings, prehistoric occupation sites, tells, earthworks, burials, and mounds. For the most part Kenyon is apparently a disciple of Wheeler. Her comments seem generally sound, but limited and overdefinite. It is the reviewer's experience that every site presents special problems and that no predetermined scheme either in digging or recording ever adequately covers all the contingencies which arise. In this book one receives little impression of the unexpected or of the flexibility needed to meet it.

Four of the 5 appendices discuss archaeological training in universities, schools of archaeology, archaeological posts, and archaeological societies. It is here that the Weinbergs have contributed corresponding summaries for the United States. The fifth appendix is a bibliography for beginners.

From the reviewer's point of view, which is that of a teacher and field excavator, this book is not sufficiently comprehensive to serve as a textbook or manual, nor is it stimulating enough to arouse interest on the popular level. However, the material that Kenyon does present is good and *Beginning in Archaeology* does merit a place on any introductory reading list.

There are, incidentally, several minor errata which should be corrected before another printing.

Down to Earth, described on the dust jacket as "a practical guide to archaeology," is written more for the amateur and the interested layman. Less pedantic and

abstract and much more lively than *Beginning in Archaeology*, it is very readable. Although even more limited to Great Britain, the presentation does in many ways give a broader view into what archaeologists are trying to do, despite less information on the minutiae of technique and less complete coverage.

Place divides her book into 3 parts, "The Use of Finds to Reconstruct Everyday Life," "Archaeological Excavation," and "Dating Britain's Past." The chapters in each follow the same chronological sequence, treating in turn the Paleolithic, Mesolithic, Neolithic, Bronze, and Iron Ages, and thus present a clearly organized pattern. Part I ends with a summary chapter on British prehistory. Part II opens with chapters on "How Sites are Found" and "How a Dig is Organized." Descriptions of sample sites drawn from each period follow. Part III begins with a few pages on geological time and then discusses various problems of absolute and relative chronological dating of the remains from each of the prehistoric periods.

Place conveys some practical and theoretical information in very readable and popular form. Her style is simple and pleasant, and the book is both attractively made up and well edited. Although limited to British archaeology and apparently aimed at the vacation amateur archaeologist, it can be of considerable value to the beginning student. The main objection to recommending it for the student's personal bookshelf is its high price.

Still Digging by Sir Mortimer Wheeler is an autobiography and belongs in a different category. Its chief interest for the American archaeologist lies in the insights it affords relative to the growth and development of modern disciplined field archaeology, a process in which the author has played an important role. In reading it one begins to understand the historical reasons behind the repetitive insistence in the other 2 books, as well as in *Archaeology from the Earth*, upon such standard field procedures as 3-dimensional recording, detailed attention to cross sections, and the like. Although Wheeler credits General Pitt-Rivers as the fountainhead of modern field technique, he points out that he himself was practically the only one of the General's students who survived World War I to carry on the tradition.

In this regard, however, one must remember that some other archaeologists also survived, and made various contributions, even if not comforming to Sir Mortimer's standards. In some ways, nevertheless, *Still Digging* does chronicle the development of systematic field archaeology in Great Britain, focusing on such important events as the creation of the Institute of Archaeology at the University of London for which Sir Mortimer claims credit as instigator, founder, and guiding hand.

In the reviewer's opinion a comparative assessment leaves Wheeler's *Archaeology from the Earth* still leading the field for the student, with Kathleen Kenyon's *Beginning in Archaeology* filling a few gaps. Robin Place's *Down to Earth* is a clear, pleasant, and stimulating introduction for the layman, and is the kind of book which would make an excellent gift for a youngster whose interests are heading in an archaeological direction. *Still Digging* gives a personal glimpse of the development of British archaeology during the last half-century, perhaps of greater interest in England than in America.

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The Wonderful World of Archaeology. RONALD JESSUP. Garden City, New York, 1956. 69 pp., 250 color illustrations. $2.95.

This is a child's book; there are many worse ones. The title implies a sort of starry-eyed ecstasy over "the glory of it all," but the book is better than the title. It is a nicely written, *Gods, Graves and Scholars* for children (from 12 to 14 probably), which seizes upon those dramatic discoveries which have been pivotal points in the study of prehistory. The importance of these several key events—such as the Rosetta Stone, the story of de Perthes, Schliemann's stubborn work at Troy, Carter's adventures with Tutankhamun, the discoveries and adventures of Catherwood, the Dead Sea scrolls, Sutton Hoo, and the value (but none of the problems) found in radiocarbon date ascriptions — survives the simple text.

But there is more than romance. The chapter headings attest the author's effort to instruct and indoctrinate before he entertains. Chapter 1, "The Past Sets a Problem" is 7 pages long; 2, "Preserving the Clues," 10 pages; 3, "Unearthing History," 22 pages; 4, "Method and Science," takes another 22 pages; 5, "The Past Has a Future," 5 pages. While one can quibble about several of his opinions or interpretations, Jessup has prepared a good book, and he has done it with good taste and enthusiasm.

The many — over 250 — pictures and diagrams are very attractive, and actually tell more than the text. This, I assume, was the objective. For a young friend who has intellectual interests, this book can be recommended.

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Neolit i Bronzovyy Vek Pribaikaliya (The Neolithic and Bronze Ages of the Baikal Area). Part III. Glazkovskoye Vremya (The Glazkovo Period). A. P. OKLADNIKOV. Materialy i Issledovaniya po Arkheologii SSSR (Materials and Researches on the Archaeology of the USSR), Vol. 43, Moscow-Leningrad, 1955. 373 pp., 177 figs. (incl. 3 maps), 6 pl., 8 tables.

This is a sequel to the monograph reviewed by the present writer 4 years ago (1953, *Am. Antiq.*, Vol. 18, No. 3, pp. 283-5). It seems justified that the present volume be entirely devoted to the Glazkovo period, since the latter is known from nearly twice the number of graves available for all other periods put together. The presentation and illustrations, as in the first volume, are

more than adequate, and the excellent drawings should be sufficient to thoroughly arouse the curiosity of the student ignorant of Russian.

The dates assigned to Glazkovo (18th to 13th centuries B.C.) seem acceptable if one grants the rough equation of Karasuk and An-Yang (end of the second millennium B.C.), the clearly pre-Karasuk date of Glazkovo, and the existence of parallels between Glazkovo and the Chinese painted pottery cultures. A mean date of 2000 B.C. for Yangshao, if qualified by generous margins for error, duration, or subdivision into metallic and premetallic phases, would seem sufficient to allow for lag in the penetration of metal to the Baikal, relative to China.

In space, the spread of Glazkovo culture includes the Angara, upper Lena, and lower Selenga river basins, each of these evidencing some distinctive regional traits.

Chapter 1 describes briefly the technological context in which metal appears, and how it affects and is in turn affected by metallurgy. Typologically, the metal tools found, particularly knives and fishhooks, still retain features derived from lithic techniques. Yet, Okladnikov makes it clear that, in his estimation, what is involved is the beginning of a true metal age, characterized by true metallurgy and far-reaching socio-economic consequences, subsequently equalled in scope only by those of reindeer breeding a millennium and a half or so later.

In Chapter 2, "The Economy," Okladnikov shows that the shift toward primary dependence on fishing noted in Kitoi times culminates in Glazkovo when, with the aid of improved technology, the economy attains heights which cause the author to refer constantly to the American Northwest Coast for functional parallels. Treebarkers, similar to those of the Eskimo, and axes in lieu of adzes indicate, in Okladnikov's estimation, the replacement of the dugout by the birchbark canoe. Hunting persists, and small triangular points with concave bases represent the result of a trend towards ,size diminution which parallels an often observed North American phenomenon. Unworked flake scars and basal thinning sometimes give these points an appearance of fluting (Figs. 99, 100, 103).

Clothing and household utensils (Chapter 3) are of interest. The former closely resembles that of the historic Tungus and is carefully reconstructed from the distribution in graves of beads, originally sewn on it. Utensils include bone needle cases, decorated with carved designs, including the well-known Eskimo circle-and-dot motif, and the oldest antler spoons in Siberia. Pottery vessels are ovoid and direct rimmed, decorated by dentate stamping, drag-and-jab, bosses, incision, and occasionally treated with a grooved paddle. Flat-bottomed forms occur in the Selenga valley.

Widespread trade (Chapter 4) in beads found at Pan Shan and Pu-Chao-Chai and in pale nephrite rings, likewise with close analogies in China, furnishes concrete evidence for the author's dating of the period.

In reconstructing social structure (Chapter 5), the author is on shaky grounds in inferring "patriarchy," especially in view of the close analogies he otherwise finds on the American Northwest Coast, for example, slavery, wealth and prestige differences, and active warfare. The entire concept of "patriarchy" in Soviet literature is highly nebulous, since one is never certain whether descent, residence, kinship terminology, or sex roles are meant. Among traits connected with warfare, slat armor and scalping are noteworthy.

Chapter 6 deals with art and personal adornment, and in particular with carved ivory and bone statuettes which have parallels both in ethnographic Siberia and among the Eskimo.

The concluding chapter concerns the inferred beliefs and ritual of the Glazkovians. It is a good example of the constructive use of ethnographic parallels, which lead Okladnikov to infer belief in spirit helpers, a particular conception of the underworld, a solar cult, and the appearance of shamanism.

Four appendices deal, respectively, with metal knife specimens of Glazkovo date from the Baikal area, the distribution of pale nephrite ornaments in eastern Siberia, the material and workmanship of beads from the site of Buret (G. G. Lemmlein), and nephrite drilling technique (S. A. Semenov).

In conclusion, it seems worth summarizing the ethnic history of Baikalia as it is briefly outlined by the author in the Introduction (pp. 7-10). While the Glazkovians and their Neolithic ancestors are seen as closely related to the modern Tungus, Okladnikov postulates the penetration of the immediate ancestors of the latter from the eastern margins of the Baikal culture area (the upper Amur) into their historic habitat around the beginning of our era. This more or less internal movement within a culturally quite homogeneous area (hence the similarity of Glazkovo and Tungus culture) is suggested by craniological evidence. Its causes may have been the pressure of tribes of Far Eastern maritime origins which replaced Baikalian-like tribes in the upper Amur toward the beginning of the Christian era, the adoption of reindeer breeding, and ensuing mobility, and incursions of Trans-Baikalian nomads who, shortly before the time of Christ, formed the aggressive Hunnic confederation. Pressure from the latter also resulted in the archaeologically attested intrusion of the Turkic Kurykan (Kurumchian) farmers into the Angara and Lena valleys, where they coexisted with taiga hunting and fishing tribes in the first millennium A.D. and are classed among the Uigur by T'ang Chinese sources. Later, as the author states elsewhere, they moved down the Lena to become the historical Yakut.

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The Ancient Maya. Sylvanus Griswold Morley. Revised by George W. Brainerd. Third edition, Stanford University Press, Stanford, 1956. x + 494 pp., 57 figs., 102 pls., 10 tables. $10.00.

The original Morley edition and the present Morley-Brainerd edition of *The Ancient Maya* make a considerable contrast. George Brainerd has done an excellent job,

but one wonders whether we are not sometimes too eager to accept as advantages the making of the crooked straight and the rough places plain. In this process much of Morley's personality and many of the views he clung to so tenaciously in the face of contrary evidence have been swept away. That extraordinary manifestation of Morley — *The author's selection of fifty Maya superlatives* — is no more, and the red jaguar throne of Chichén Itzá is no longer "the most outstanding object ever discovered in the New World." Perhaps such characteristic bits of Morleyana had to go, but one does regret the disappearance of little touches such as a comparison of getting the ball through the ring in the ball game to a hole-in-one at golf. Morley's ideas on the history of Yucatán were tenaciously held in the face of evidence which most of his colleagues then thought pointed to a scheme such as Brainerd now presents in their place. One might question whether a Republican should revise the political writings of a Democrat, or that Morley's book should have been reedited in this way, for the result is neither Morley nor Brainerd. Starting from scratch, Brainerd certainly could have done better.

The historical outline now followed is that which Brainerd offered 8 years ago in a review of *The Ancient Maya* (1948, *Am. Antiq.*, Vol. 14, No. 2, pp. 133-6), a splendid piece of critical writing with which this reviewer was and still is in full agreement. Brainerd clearly tried to keep as far as possible to the original scheme of presentation, yet his widening of Morley's restricted horizon is seen in more attention to such centers as Tula and Teotihuacán, but probably not as much as he would have devoted to contemporary non-Maya cultures had he started the book de novo. The Classic period is no longer defined largely in terms of dates on Maya monuments. This widening of interest is well reflected in the presentation of the historical material in Table III in the 2 versions. For example, in Brainerd's table there is a column for events in the highlands of Guatemala, a region not sharing Maya culture in Morley's narrow definition of it. Needless to say, the outline of developments in Yucatán receives much fuller and more reliable treatment than in the original book. The picture is now based largely on Brainerd's own work in the field rather than on the fundamentalist belief in the verbal inspiration of the Books of Chilam Balam which characterized Morley's reconstruction. A précis of the recent work of Carnegie Institution of Washington at Mayapan is also included.

Ruthless pruning has not only made room for the opposing ideas of Brainerd and for data which have come to light since Morley's death, but has actually reduced the length of the book by 150 pages, a shrinkage masked by paginating the plates in this edition! If this is a precedent, every author must tremble at the thought of what massacre may not await his brain children once he is safely across the Styx. Betty Bell has contributed a final chapter, "An Appraisal of the Maya Civilization," which briefly presents a stimulating evaluation of the culture with the fresh approach of one not too specialized in the area. By cutting down Morley's unwieldy (35 pages) bibliography, she makes room for notes — largely of sources — for each chapter, a most useful improvement. There are also new plates covering recent discoveries at Bonampak and Palenque.

There are no lists of plates, text figures or tables, which are serious defects. Several errors persist from the first edition to mar an otherwise creditable example of bookmanship.

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Archeology of Zion Park. Albert H. Schroeder. Contributions by Myrl V. Walker, Russell K. Grater, Katharine Bartlett, Irene Emery, Volney H. Jones, and Ben W. Wetherill. University of Utah, Department of Anthropology, Anthropological Papers, No. 22, University of Utah Press, Salt Lake City, 1955. vii + 212 pp., 26 figs., 22 pls., 23 tables. $2.25.

Schroeder's report describes the material recovered from a surface survey and the excavation of a few sites in and around Zion National Park by the National Park Service, under the direction of the late Ben Wetherill in 1933 and 1934. The Introduction summarizes the archaeological work completed in southern Utah, northwestern Arizona, and southern Nevada from 1875 to the present. The geological and geographical setting of Parunuweap Canyon is described in an excellent section by Myrl V. Walker.

Following the practice of the Anthropological Papers of the University of Utah, Schroeder next presents a general statement of the archaeological culture of the area and its relationships to cultures outside the area. This manner of introducing the conclusions in the beginning of the report permits the reader to follow the detailed descriptive notes more intelligently.

Schroeder believes that the Zion region developed independently of central and northern Utah and was more closely associated with southern Nevada and the Arizona Strip, north of the Colorado River. He feels that periodically the more highly developed Basketmaker-Anasazi culture of the Four Corners region made its influence felt in the Zion-area. Robert's classification is used to describe the cultural development of the area, even though the author admits that it is not an entirely satisfactory system. Phase names have been withheld until the completion of further work in southern Nevada.

Subsequent sections deal with the excavated or tested sites, and an account of the survey sites. There is a detailed analysis of the pottery; correlations between temper and decorative treatment are noted as are apparent temporal changes. The artifacts recovered from the sites are treated according to the material of which they are made. A section on "Food Items" forms the exception. Five appendices dealing with surveys, skeletal material, netting, and plant remains close the report. It is to be regretted that such information, is usually added

almost as an afterthought instead of being included, in a more meaningful position, in the body of the report.

The photographs of site features reproduced well considering their age. Figure 1, the map of the Zion Area is almost unreadable, and has no direction indicator. The line drawings are generally clear. Plates 15, 19, and 20, which are photographs of artifacts, are quite poor and it is difficult to see the detail of the items represented.

Schroeder undertook the difficult task of preparing for publication from incomplete notes the results of field work in which he did not participate. The generally good job he has done is to be commended, and it places before students of the area a very useful body of material.

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Tierradentro. Archäologie und Ethnographie einer Kolumbianischen Landschaft. HORST NACHTIGALL. Mainzer Studien zur Kultur- und Völkerkunde, Band 2, Institut für Völkerkunde, Johannes Gutenberg-Universität, Mainz. Origo Verlag, Zürich, 1955. cxxiii + 327 pp., 37 figs., 213 pls., 2 maps. 52 sfs.

Tierradentro is the name of a rugged mountain area which lies between the upper Magdalena and Cauca rivers, in the Andean heartland of southern Colombia. In the 16th century the Spaniards found the region inhabited by the Páez Indians, some 25,000 of whom still survive in a more or less acculturated state in the mountain valleys. The attention of archaeologists was drawn to this region only some 20 years ago when a series of stone statues and many subterranean tombs with painted walls were found. As Tierradentro lies only a short distance to the north of the San Agustín area, these finds acquired particular importance, but after the initial discovery little systematic work was done and the prehistoric relationships between the 2 areas were never clearly defined.

Nachtigall, who worked in Tierradentro for several months in 1952-53 under the auspices of the Instituto Colombiano de Antropología, presents in this volume the results of his archaeological and ethnographical researches. The book is divided into 2 separate parts, the first and shorter one containing site descriptions and an account of the author's own excavations in a series of burials, while the second part consists of a lengthy description of the modern Páez.

In his archaeological investigations the author places strong emphasis upon stone sculptures and tombs, the 2 outstanding features of the Tierradentro culture, giving a very complete and interesting description of both. However, from the specialist's point of view, the author seems to have done this at the expense of other aspects of the archaeological culture which might well have deserved a more thorough treatment, and to this reviewer, at least, many of the author's remarks are more tantalizing than illuminating. A flint arrowhead excavated in a trench is neither described nor illustrated; resist-dye wares are frequently mentioned but hardly ever described in sufficient detail, and the only illustration given of them is quite inadequate. A technical, quantitative, and qualitative description and analysis of ware types is lacking and makes it difficult to visualize the ceramics. No rim sections are illustrated and decorative techniques or elements are often described in terms which do not clearly express important details. It is also rather disturbing to hear the author refer to potsherds by the pound, instead of giving exact quantitative data. In a short résumé Nachtigall traces some parallels between Tierradentro, San Agustín, and the cultures of the Cauca Valley, concluding that the Tierradentro style represents essentially an epigonal phase of the San Agustín culture. By attributing to the latter a terminal date in the 8th century A.D., Nachtigall places the Tierradentro culture between this date and the 14th century, after which he believes the Páez to have invaded the region. As these conclusions are not based upon clear-cut stratigraphic evidence, nor upon detailed typological comparisons of the pottery, they are, of course, highly hypothetical.

The ethnographic part of the volume contains some fine technological chapters and a valuable discussion of shamanism. Nachtigall does not believe that the Páez are culturally or linguistically related to the Chibcha, nor does he venture to suggest affiliations with other groups.

In spite of its shortcomings, this book is valuable as an introductory study, offering a good over-all picture of an important cultural region. As most of the existing literature on Tierradentro is widely scattered through local publications which are often quite inaccessible to the foreign scholar, Nachtigall has rendered a service by presenting a compact volume on this region. This is a handsome and well-printed volume with many excellent photographs and line drawings. Unfortunately there is no index.

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Nordperuanische Keramik. Figürlich verzierte Gefässe der Frühe-Chimu. Cerámica del Perú septentrional. Figuras ornamentales en vasijas de los chimúes antiguos. GERDT KUTSCHER. Monumenta Americana I, Ibero-Amerikanische Bibliothek, Verlag Gebr. Mann, Berlin, 1954. 82 pp., 80 pls. DM 50.

Half a century ago, the great German Americanist Eduard Seler undertook to write a richly illustrated book on the figure-painted designs of vessels of the Moche (Proto-Chimu, Early Chimu) style. He engaged as draughtsman for the project the artist Wilhelm von den Steinen, brother of the ethnologist, who had already worked on Peruvian pottery designs for Arthur Baessler. The illustrations were completed and the plates made by March, 1908, but the publication of the work was interrupted for some reason. The plates, the original draw-

ings, and any text Seler may have written are all lost; fortunately, however, 2 sets of proofs of the illustrations have been preserved. Gerdt Kutscher has done American archaeology the great service of publishing Steinen's drawings with annotations and an introduction. The result is a book of great beauty which will be useful to all who wish to study Moche design or reconstruct Moche culture.

The text of the book is printed first in German (pp. 9-43) and then in a Spanish translation by Peter Bock (pp. 44-77), a feature which increases its usefulness. The introduction consists of some brief general remarks on the Moche style and an account of the history of the illustrations. The notes for each specimen give its provenience, if known, its present location, remarks on the interpretation of the designs, and references to other published illustrations.

The designs from about 200 specimens are illustrated wholly or in part in the form of roll-out drawings printed in dark red on a cream paper. There are additional sketches showing the shape of the vessel and the placement of the design for only 37 of the specimens. The roll-outs are carefully done and reasonably accurate, though occasional mistakes can be found by comparing the drawings with photographs of the same specimens. Steinen had a tendency to soften the angles, thin the lines, and smooth out uneven strokes in his reproductions. If such details are important, as they might be in a study of Moche draughtsmanship, Steinen's illustrations should be used with due caution. For most purposes they are perfectly adequate.

Seventy-two of the specimens shown have been previously illustrated, in some cases from the same Steinen drawing. Thirty-two of this total have been illustrated by photographs.

Very few of the specimens illustrated have useful and reliable provenience data. Thirty-six are said to come from Chimbote, five from Chicama, and one from Virú. The rest are labeled simply "Trujillo" or "Trujillo province" if any provenience at all is given. Most of the specimens shown are from the collections of the Museum für Völkerkunde, Berlin, but nine are in Bremen, five each in Frankfurt a/M and Hamburg, seven in the British Museum, and one each in Paris, Lübeck, and the Gaffron Collection (now at the Chicago Art Institute).

Kutscher mentions the problem of Moche chronology in his introduction but does not deal with it in any systematic fashion. He has grouped the Steinen drawings by subject in 6 general categories, and his notes on individual specimens deal mainly with iconography. His comments are always interesting, though they occasionally go well beyond the evidence. For example, the bird-faced figure in 66 A is just as likely to represent a man wearing a mask as it is a demon. It is a fair inference that the vessels depicted around him held something to drink, but Kutscher is making a large assumption when he says it was intoxicating.

Since Seler, like Kutscher, was interested in Moche representation, no purely geometric designs are shown. The reader should remember, however, that a considerable proportion of Moche painted design is geometric.

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Orfebrería prehispánica de Colombia. Estilo Calima. JOSÉ PEREZ DE BARRADAS. Banco de la República, Museo del Oro, Bogotá, 1954. 2 vols. Text: xvii + 367 pp., frontis., 201 figs., 20 color pls.; Plates: 19 pp., 300 pls.

These 2 handsomely illustrated volumes describe and analyze the gold work from the Calima valley within the context of prehistoric Colombian metallurgy. Most of this important collection of gold, which constitutes one of the principal treasures of the Museo del Oro, was acquired since 1941.

Although most of the pieces were purchased, the author adduces convincing evidence to show that a large number of them have the same general provenience, the *municipio* of Restrepo. He uses this circumstance as the basis of his description of the pieces and his definition of the Calima style. This approach makes it easy for the reader to follow the author's reasoning in setting up his style and his extension of it to pieces lacking provenience.

Perez de Barradas begins the work with a brief but comprehensive recapitulation of literature on prehistoric Colombian metallurgy which brings into sharp focus the relatively late discovery date of the gold work center to be discussed. The scant archaeological work done in the Calima area is also reviewed in some detail; although, as the author frankly admits, so little has been accomplished that there is yet no firm base upon which to relate the Calima style to any of the little-known "complexes" of the Calima valley.

The description of the objects is quite succinct. Emphasis is given to excellent detailed illustrations. Metallurgical analyses accompany the description, and where known, the technique used is discussed.

The richness of the Calima gold production, aside from providing us with aesthetic pleasure, raises the questions of its socio-economic base and its duration. The author mentions some of the many reasons for believing that the Calima gold work depended upon broad trade connections rather than upon a relatively self-contained cultural pocket for its unusual development. This hypothecated trade nexus appears to have disappeared by Conquest times. Calima style would appear to have had its climax, if not as the author supposes, around the 8th century A.D., perhaps somewhat earlier. Typological linkages to the south would tend to place it between the Chavinoid and Tiahuanacoid periods. Although the author's postulation of cultural contemporaneity between San Augustín and the Calima style appears a bit strained, some type of relationship in terms of artistic traditions may ultimately be established.

This study will be a primary source in South and Central American archaeology, providing as it does a wealth of hitherto unpublished motifs in the prehistoric Colombian iconography. There are many specimens, both in gold and stone, which could be singled out as evidences of distant contacts. This procedure will be infinitely more fruitful, however, when (as it is hoped) the Calima style passes from its present status as just one more "floating artistic style" and receives a firm placement in the Colombian cultural sequence.

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Portland Point, Crossroads of New Brunswick History. Preliminary Report of the 1955 Excavation. J. RUSSELL HARPER. Historical Studies No. 9, New Brunswick Museum, Saint John, 1956. 51 pp., 21 figs., 1 map.

Saint Louis, Huron Indian Village and Jesuit Mission Site. WILFRID JURY AND ELSIE MCLEOD JURY. Museum Bulletin No. 10, Museum of Indian Archaeology, University of Western Ontario, London, 1955. 76 pp., 11 figs., 5 pls., 2 maps. $1.00.

Excavations at Green Spring Plantation. LOUIS R. CAYWOOD. Virginia 350th Anniversary Commission and Jamestown-Williamsburg-Yorktown-Celebration Commission, Colonial National Historical Park, National Park Service, Yorktown, 1955. 26 pp., frontis., 17 pls., 6 maps.

The Northwest Gun. CHARLES E. HANSON, JR. Publications in Anthropology, No. 2, Nebraska State Historical Society, Lincoln, 1955. xii + 85 pp., 1 fig., frontis., 29 pls. $3.00.

The publication of these reports highlights the growing interest in historic archaeology in both Canada and the United States.

Excavation of Portland Point, New Brunswick, Canada, was originally stimulated by a dispute over the location of Fort La Tour, the first major French fort in New Brunswick (1631-1645). The results of the first season of excavation, 5 culture horizons in stratigraphic sequence, are described briefly in this preliminary report. The earliest horizon produced 5 "Red Paint" burials which the author tentatively compares with the "Maine Cemetery Complex." Overlying these burials were found stone flakes, thumbnail scrapers, and projectile points which may be of late prehistoric or early historic Micmac or Maliseet affiliation. Fort La Tour itself, in the third or middle cultural deposit, is represented by a section of the palisade, a probable bastion, and a cellar. Artifacts typical of the fur trade, military weapons, and French glass and pottery support the documentary dating of the Fort. A contact period burial, probably of Micmac affiliation, appears to have been made shortly after destruction of Fort La Tour. The latest occupation began with the first English-speaking settlement on the St. John's River. Excavation of the Simonds, Hazen, and White Trading Post, built probably in 1764, provides early evidence of dish imports from the American colonies. Appendix A describes a 17th century Micmac Copper Kettle burial at Pictou, Nova Scotia, which illustrates graphically the impact of the fur trade on the life of the Indian at the time Fort La Tour was operating. Appendix B discusses types and uses of matting and netting of the Micmac and Maliseet, as derived from study of archaeological material recovered from Portland Point, Pictou, and Redbank. There is no map which locates Portland Point within New Brunswick. Artifact descriptions lack standardization and very often quantification. Seldom is specific provenience other than general vertical placement given. Photographs fail to show desirable detail in some instances; line drawings would have improved the description of the Indian-made stone artifacts which are treated rather summarily. Ceramic treatment consists of a brief discussion of various forms and types found — no Indian pottery was discovered. As a preliminary report the book is nevertheless outstanding; possibly the author intends in the final analysis to treat the artifacts recovered in 1955 more extensively. Pollen analysis might be a productive technique to apply to this site.

Cultural remains excavated at Saint Louis include the church, 11 longhouses, 2 refuse pits, and the palisade. The site is located in Simcoe County, Ontario, in the heartland of historic Huron country; the village contains an area roughly 800 by 400 feet within the palisade, and is flanked by 2 refuse pits which each extend from 75 to 110 feet along the river bank. The mission evidently came into existence in the 1630's; no speculations are made concerning the possibility of an earlier occupation of the site. A fascinating eye-witness account of the destruction of Saint Louis at the hands of the Iroquois in 1649 is contained in Appendix C and is used throughout the report for comparative purposes, and to substantiate the identification of the Huron mission. The site, which had been plowed to a 9-inch depth, has been a choice spot for collectors for many years so that natural stratigraphy was somewhat disturbed; possibly this is the reason no profiles of the site are included.

Although excavation was done in 2-inch levels, and the refuse pits apparently had depths of 5 to 12 feet, no attempt is made to study any of the material stratigraphically. In 3 seasons work 14,518 sherds and 229 European artifacts were recovered. Pottery, which "is but a small portion of the pottery known to have been removed from this site," is briefly described as Huron Incised, Warminster Crossed, and Sidey Notched. The amounts and proveniences of these types, as well as the proveniences of the majority of other artifacts, are not given. No European ceramics are reported. Over 150 stone artifacts were recovered; four of these are measured roughly, but none are illustrated. In the summary a general comparison is made to other historic and prehistoric sites excavated by the authors. The work of Kidd, Ridley, Popham, and Emerson in the field of historic Huron archaeology appears to be ignored. The report does not gain by its poor

editing, lack of organization, shadowed photographs, and inadequate maps and figures.

Green Spring Plantation lies 3½ miles north and slightly west of Jamestown, Virginia. In preparation for the celebration of the 350th anniversary of the founding of Jamestown, the National Park Service undertook excavation of the famous 17th century manor house of Sir William Berkeley, Governor of Virginia from 1641-1652, and again from 1660-1677. Two main architectural units are defined by Caywood with the help of documentary sources. The earliest of these, designated the Old Manor House, is believed to be the structure built by Berkeley by 1649. It is overlain in places by the later structure, the Mansion House, which was in existence in 1781, and was possibly built soon after the death of Sir. William. This later house was dismantled in 1797. One of many outbuildings excavated is the only 17th century pottery kiln known in Virginia. Red body wares without glaze, or with interior lead glaze, were produced there under the direction of Sir William.

Treatment of the ceramics is cursory; data on quantity and provenience are not presented for any of the 13 listed types. The variety of clay pipes and the dating problems these present are discussed only briefly. Metal objects — hoes, equestrian items, hardware, spoons, tacks — are presented in greatest detail in the illustrations. Caywood states that 40% of the artifacts appear to date from 1650 to 1675 and about 25% date from 1675-1700. The site apparently fills a gap between the period of Jamestown's heydey and the renaissance of English culture at Colonial Williamsburg. Maps and plans are well executed, photographs are excellent considering the format, and illustrations of the metal artifacts and ceramic forms are artistically done. It might be enlightening to know the proportion of ceramic types within each architectural unit. This report is in the style of other Park Service publications concerned with interpretation and restoration of sites for the public. Unfortunately, many details normally found in archaeological reports are omitted in this style of publication.

The Northwest Gun was the first gun specifically developed for and used by the Indians. It was a cheap, lightweight, smoothbore, flintlock which was manufactured in a number of places with certain variations in style and design. It was distributed to the Indians via the traders or the Indian Bureau, and was in common use among the Indians from 1775 to 1875. Hanson says, "Probably no other model of gun in American history had such widespread use for so long a period. . . . A hundred years ago they were in daily use from the Ohio Valley to the peaks of the Rockies and from the Mexican border to the Arctic Circle." This report is meant to serve not only as a study of the sources and distribution of the Northwest Gun, but also as an identification manual for collectors, historians, and archaeologists.

Chapters discuss in detail early types of trade guns; the Hudson Bay Company's leadership in stimulating the fur trade and providing guns; the introduction of the Northwest Gun and its manufacturers, dates, and general styles; the roles of the American Fur Company and the Indian Bureau in the distribution of the Northwest Gun; the identification of these guns; Indian rifles, the weapons of frontier warfare; and British guns distributed for special functions or occasions. Photographs are voluminous and good, illustrating general shape and the variety of specific parts. Documentation throughout is thorough and interesting. The inclusion of drawings of specific parts to show the interior arrangements, and a glossary would have added greatly to the book's value as a guide for the nonspecialist. This is an important and handsome contribution to the slowly growing body of reports on trade goods.

Rex E. Gerald
The Amerind Foundation, Inc.
Dragoon, Arizona

NOTES AND NEWS

EDITED BY CLEMENT W. MEIGHAN

GENERAL

A casual survey of the projects reported in Notes and News" for the summer of 1956 affords some comparative data on recent field activity. Although the count makes no pretense of completeness, it is interesting to compare field work for the summers of 1955 and 1956.

Summers:	1955	1956
Institutions and organizations sponsoring field work	58	41
Survey projects	26	23
Excavation projects	56	74
Field schools	10	8

A general similarity between the 2 summers is noted except for a marked increase in the number of site excavations during the past summer. During the last 2 years, some 200 sites have been excavated in the New World, the great majority of them within the United States.

The Foundation for Anthropological Research in Latin America has recently been established, with incorporation in Texas, as an independent, nonprofit, tax-free organization to receive and disburse funds for use in ". . . anthropological research, education, and publication in Latin America and those areas of the United States which have, in the course of their aboriginal or recent history, come under the influence of Latin American cultures." The Foundation will serve solely to receive and disburse funds raised by scholars or organizations, and will not itself seek money, make grants, or initiate research projects. Its aim is to serve donors and scholars who are not affiliated with institutions empowered to receive and administer tax-free contributions, and it will be able particularly to serve foreign scholars who are able to raise research funds in the United States. The Foundation's organization will be described in full detail to anyone interested. Inquiries should be addressed to Executive Offices, FARLA, Apartado Postal 2242, Mexico, D.F., Mexico.

PIPELINE ARCHAEOLOGY

Reports on salvage operations in the Southwest on El Paso Natural Gas Company Projects, from 1950 to 1953, published jointly by the Laboratory of Anthropology and the Museum of Northern Arizona, was issued late in 1956. This 436-page volume is logically dedicated to the El Paso Natural Gas Company which paid the cost of field operations, and subsequently contributed to the Laboratory of Anthropology and the Museum of Northern Arizona most of the funds needed to prepare and to publish this report. The introduction by Jesse L. Nusbaum includes the history of establishment of pipeline salvage work and related procedures. The reports on field operations, prepared by twelve of the pipeline archaeologists and 2 invited archaeologists, were assembled at the Laboratory by Fred Wendorf, Nancy Fox, and Orion Lewis, in accord with a Museum of New Mexico cooperative commitment. Under a comparable cooperative agreement, the Museum of Northern Arizona is paying part of the publication cost.

Since the start of construction in mid-June, 1955, Pacific Northwest Pipeline Corporation, in cooperation with scientific organizations and government agencies, has paid the cost of surveying and salvaging the archaeological values that 1486 miles of big-inch pipeline construction, and nearly 800 miles of connecting lateral construction, would have irreparably damaged or destroyed within rights-of-way between the No. 1 Compressor Station at Ignacio, Colorado, in the San Juan Basin gas fields of Colorado and New Mexico, and the Pacific Northwest states of Oregon and Washington to the Canadian border. By late fall of 1956 San Juan Basin gas was being delivered to wholesale customers in Washington and Oregon. Up to 6 archaeologists were required to keep apace of contract construction on all spreads of this primary system. Two of these pipeline archaeologists since early fall have completed archaeological work on over 222 miles of the yet-expanding gathering trunk and lateral feeder line system which radiates outward from the No. 1 Compressor Station far southward and eastward into New Mexico and Colorado through gas field regions practically unknown archaeologically.

The latest story on how this Pacific Northwest Pipeline System was built, as told by the men who planned and built it, includes a brief preliminary report by Jesse L. Nusbaum, "What the Archeologists Found Along the Right-of-way." The entire illustrated story, featured in the October issue of *The Petroleum Engineer*, has been reprinted by Pacific Northwest Pipeline Corporation for general distribution under the title, "Gas For The Pacific Northwest." Pacific Northwest has a limited number of copies for especially interested institutions and persons; they may be requested through A. F. Lorton, Jr., Director of Public Relations, P. O. Box 1526, Salt Lake City 10, Utah.

Since late February, Tom Cummings, with Navaho labor completed archaeological field work on El Paso Natural Gas Company's liquid products loop line construction between the Blanco Treatment Plant north of Bloomfield to the Fractionating Plant just east of Gallup, and is now nearing completion of survey and salvage operations on El Paso's new 34-inch gas line from the Blanco Treatment Plant across a new right-of-way to north of Gallup, from which point it loops or parallels the previously controlled 24-inch and 30-inch lines in the widened San Juan Right-of-Way, westerly to the Leupp Compressor Station on Little Colorado River. Earlier Paul Ezell completed survey and salvage work on this 34-inch gas line in the Flagstaff region, and on El Paso's new 20-inch line from Ash Fork southward to near Phoenix.

In early May, for the month prior to Carling Malouf's availability for the summer period, a graduate assistant at the University of Montana, David Larom, initiated survey and salvage on the second, or final 238-mile construction spread from southwest of Green River, Wyoming to Laramie, on Colorado Interstate Gas Company's 374-mile 22-inch gas line from Green River to Denver. During the summer of 1955 Malouf recorded 88 sites, largely tipi rings, between Denver and Laramie, and in 1956 Larom and Malouf recorded 90 additional sites, 85% within right-of-way, but encountered no tipi sites west of Rawlins.

EARLY MAN

BRAZIL. The Lagoa Santa Project in Minas Gerais state, directed by Wesley R. Hurt of the University of South Dakota, was active during the summer and early fall of 1956. Although the beliefs previously held by some that this material is of high antiquity because of the presence of bones of extinct Pleistocene animals were not borne out, the project may best be discussed under the heading of "Early Man." A fuller account may be found in *Museum News*, Vol. 18, Nos. 9-10, published by the W. H. Over Museum, University of South Dakota, Vermillion.

Excavations were made in 8 caves and rock shelters in the areas of Cerca Grande and Matozinhos. In all of these localities distinct stratigraphic breaks were encountered between the levels of human occupation and older strata which contained bones of extinct animals. No radiocarbon dates have yet been obtained but Hurt is of the opinion that no evidence has yet been found for human occupation of more than a few thousand years in this area.

In the Cerca Grande area northeast of Pedro Leopoldo, 6 caves and rock shelters were selected for excavation. Shelters 1 to 5 lie below a series of caves cut in the face of a cliff by an extinct Pleistocene lake, while Caves 6 and 7 lie well above this lake level. The Danish naturalist Wilhelm Lund in 1836 found the remains of many Pleistocene animals in one of thé caves cut by the extinct lake. The Gruta das Boleiras, another cave excavated in 1956, lies many meters above this lake level. In spite of the fact that some of the caves explored in 1956 lie below the highest level of the Pleistocene lake, and others above this level, no differences were noted by Hurt and his associates in the cultural material. The Gruta de Lapa do Chapeu, the highest of these caves, revealed only a ceramic occupation.

Evidence was found for fluctuations in climate but the Pleistocene fauna was not associated with the human occupations. From the 8 caves excavated in 1956 Hurt concludes that: "Two distinct cultural complexes occurred in the area. The oldest, referred to as the Cerca Grande complex, was characterized by polished celts, quartz-crystal flakes and scrapers, bone projectile points, and both pitted and unpitted hammerstones. Burials were made in the occupational deposits, usually in rock-covered and rock-lined graves, in the completely flexed position, either sitting or on the side. The age of this culture appears relatively recent, perhaps no more than a couple of thousand years for the oldest occupations. The later occupation was characterized by a few ash beds, cache pits, and fireplaces of Indians who left a simple type of pottery in the uppermost levels. As yet the human skeletons have not been studied. A superficial examination reveals them to be typical examples of the Lagoa Santa type."

TEXAS. Members of the newly created East Texas Archeological Society, led by Antonio A. Andretta and Buddy C. Jones, have excavated a series of small caves near Cary Lake in western Cherokee County. They have received the advice and assistance of E. H. Sellards and Edward B. Jelks, director of the Texas Memorial Museum and Texas representative of the National Park Service Basin Surveys, respectively. Stratified deposits extend from early Postglacial time to modern time. Soot concentrations occurred on the cave ceilings above hearths in which Plainview points, charred human bones, and charred animal bones were found. Seeping water in the lowest levels forced temporary abandonment of the excavation. Jones reports that as of September 3, they had found 29 probable Plainview points, one Folsom point base, one Scottsbluff point, teeth of extinct bison, 3 hearth areas in the oldest levels, parts of 8 human skeletons, some partly fossilized, and a variety of knives, scrapers, and other artifacts of a general Archaic nature. Two of the 4 cave "rooms" had been excavated at that time.

Still another radiocarbon date has been obtained by Fred Wendorf and Alex D. Krieger on the site of the now famous Midland skull in western Texas. This date was obtained by the Lamont Geological Laboratory on Sample L-347 by extracting carbon from caliche rock which had been used as hearth-lining material in a pit lying within the gray sand, the same stratum which contained the human skull. The calculated age is 20,400 ± 900 years. Burned bones of an extinct antelope (*Capromeryx*) were found in the same hearth. Although this data is considerably greater than the 12,500 years obtained from pond-snail shells in the white sand (AMERICAN ANTIQUITY, Vol. 22, No. 3, p. 323), and the datings of about 8670 and 7100 years from inadequate samples of unburned fossil bone reported in *The Midland Discovery* (pp. 9, 99), it is important to note that it is in essential agreement with 3 datings obtained by an entirely different method, not yet reported or described in print. The latter is known as the "Rosholt method," the "uranium isotope method," or the "uranium daughter-products method." A test made of fossil bones from the Midland locality in the spring of 1956, by Dr. Rosholt of the U.S.G.S. in Denver, was reported to the writer as yielding dates of 19,000, 17,000, and 15,000 years, respectively, by the measurement of 3 different uranium isotopes found in minute quantity in the fossils.

At this writing, the real age of the Midland skull is more difficult to determine than ever. Wendorf and Krieger are preparing a new study of this intriguing prob-

lem, in which the new isotope method will also be discussed. While some nuclear physicists are doubtful that it will yield results as accurate as the C^{14} method within the effective age range of the latter, the range of the uranium isotope method is unlimited, it is free of contamination problems, and it holds promise for dating phenomena of the Pleistocene beyond the range of C^{14}. At present, Wendorf and Krieger are having tests made on fossil bone samples from other sites which have already been dated (perhaps not always satisfactorily) by C^{14}.

CALIFORNIA. The Southwest Museum is undertaking a survey of dry-lake drainage systems in the Mohave Desert under the direction of Ruth D. Simpson, associate curator. Field work has been completed in 2 areas, Coyote Gulch and Koehn Dry Lake. Manuscripts have been prepared for the Southwest Museum's new mimeographed series of Mohave Desert Survey Reports. Currently, field work is being concentrated in the Manix Lake basin east of Barstow. Lithic material collected from these localities represents not only late Paiute and the older Playa industries, but also assemblages of crude and heavy implements which are typologically, and perhaps temporally, earlier.

George F. Carter reports a radiocarbon date of greater than 38,000 years on charcoal from the Texas Street site in San Diego, determined by the Lamont laboratory. He reports that the charcoal came from "a hearth near the base of the lowest occupation level. . . . and 41.6 feet beneath the original ground cover." As this terrace is some 120 feet high and Carter has previously published statements that cultural material was found "throughout" it, the above data suggests that only approximately the upper one-third of the terrace has occupation material. No report has yet made clear what the hearths look like and the possibility remains (in the minds of the writer and others who have visited the site) that the charcoal may be of natural origin — that is, the result of brush or forest fires. Carter also reports the discovery of marine shells of species now found in warmer, Mexican waters, and burned animal bone in addition to burned rock previously reported. The writer has been very dubious that this pink granitic rock was burned, by man or any other agent. Archaeologists will await with interest Carter's full report on this site, particularly a description of the hearths, with photographs and provenience data on the various phenomena noted.

NEW MEXICO. Confusion concerning radiocarbon dates reported from Sandia Cave has been partly cleared up by the recent statements by Frederick Johnson and Frank C. Hibben in *Science* (Vol. 125, pp. 234-5, Feb. 8, 1957). It will be recalled that in 1955 (*Science*, Vol. 122, pp. 688-9, Oct. 14, 1955), Hibben stated that, "In 1948, two specimens of charcoal from fire hearths of the Sandia level of Sandia Cave were submitted by Kirk Bryan of Harvard University to W. F. Libby of the University of Chicago for C^{14} dating. . . . From these two samples, tentative dates of 17,000-plus years ago and 20,000-plus years ago, respectively, were derived. Bryan was emphatic that these dates should not be published at that time, because of the inadequacy of the samples and the possibility of a considerable error."

Farther along in the 1955 article, Hibben stated that, "Although no definite fire hearths are found in this Folsom level [of Sandia Cave], enough charcoal was derived from the debris for a single inadequate C^{14} run at the University of Chicago Institute for Nuclear Studies." He gives no age determination for this sample except that it indicated a "comparable antiquity" with the Folsom dating of 9883 ± 350 years from the Lubbock site. H. R. Crane, however, in the same issue of *Science* (p. 689) stated that "The Folsom level [of Sandia Cave] had been dated by C^{14} on a previous and inadequate sample of ivory [sic] fragments at about 11,000 years."

In *Science* for February 8, 1957, Johnson states that, "There is no proof that these alleged dates [of 17,000-plus and 20,000-plus years ago] were ever determined by radiocarbon analysis or that Bryan ever submitted any samples from Sandia Cave to any laboratory. . . . The dates must be struck from the record before they cause further confusion." Johnson mentions other dates of 11,000 and 19,000 years ago for the Folsom and Sandia levels of Sandia Cave, published in 1951 by Hugo Gross as an oral communication from Dr. Hibben (*Bull. Texas Archeol. and Paleontol. Soc.*, Vol. 22, p. 114), and states that these dates differ significantly from those published by Hibben in 1955. Hibben, in the statement accompanying Johnson's, agrees that the 2 dates supposedly obtained by Bryan on charcoal from the Sandia level of Sandia Cave should be stricken from the record. He says that the dates published by Gross were extracted from a series of lectures given by Hibben at the University of Erlangen in Germany and that Gross must have confused radiocarbon dates with those derived by Bryan from geologic work in Sandia Cave.

Hibben further states that, "Gross is in error in his dates of 11,000 and 19,000 year [ago], respectively, for the Folsom and Sandia layers of Sandia Cave." Instead, the dates given in the Erlangen lectures were 9000 B.C. and 17,000 B.C for these levels. Another date, of 11,000 B.C. for a "Yuma site" was given but is irrelevant here for presumably it has nothing to do with Sandia Cave. The writer fails to see the difference between the Gross dates of "years ago" and those given by Hibben as "B.C."; and there are other questions that have yet to be clarified.

In 1955 Crane stated that 2 fragments of mammoth tusk had been submitted to the Michigan laboratory by Hibben in 1952, a third tusk fragment in 1954. The first 1952 sample produced a dating of at least 20,000 years; no dating is quoted for the second 1952 sample; and the 1954 sample was said to have given a "very conservative lower limit" of 25,000 years while a lower limit of 30,000 years would have been consistent with the laboratory techniques carefully described by Crane. Crane added that proof was needed that these "ivory" dates were contemporaneous with evidences of human habitation in Sandia Cave.

In the Johnson and Hibben statements in *Science* for February 8, 1957, no additional clarifications are given on the latter problems, although, as both of them point out, it is different from and unrelated to the first problem.

Assembled by ALEX D. KRIEGER

ARCTIC

ALASKA. During the late weeks of last summer J. L. Giddings, Director of Brown University's newly acquired Haffenreffer Museum of the American Indian, conducted an archaeological reconnaissance in the Eschscholtz Bay and Buckland River region of western Alaska. Giddings was accompanied by Robert Ackerman of the University of Pennsylvania and Melvin Reichler of Brown University, and his project was supported by a grant-in-aid from the Arctic Institute of North America. The most interesting site of the trip was discovered on the Chukchi Sea side of Choris Peninsula. There, on the oldest of 9 successive beaches, 3 extraordinarily large oval house pits were found. Diagonally in front of each was a smaller oval pit, probably once a sweat house. None of these depressions had signs of entrance passages. Upon excavation one of the large pits was found to have had an evenly elliptical floor with diameters of 38 and 18 feet. There was no fireplace, but a large stone lamp found there was the probable source of heat. The construction of the house was based on 2 curved rows of central posts which resembled in plan the floor pieces of an umiak. Giddings estimates that this house was occupied between 3000 and 4000 years ago, and believes it to be the earliest coastal house yet known in the Bering Sea region. Associated cultural material has not yet been described, but Giddings states that it is definitely earlier than the Norton Bay culture, and notes that bone and other organic artifacts were quite well preserved.

YUKON TERRITORY. Richard S. MacNeish, of the Canadian Museum of Natural History, spent most of last field season at his Firth River site near the Alaskan-Canadian border. This third year of work emphasized the filling of gaps in the occupational sequence and the correlation of geological, faunal, and archaeological data.

The earliest cultural material, known as the British Mountain complex, is found in an old humus above a blue marine clay which correlates with the penultimate advance of the Laurentian ice sheet in this area. Bones indicate that "caribou, some kind of extinct deer, giant bison, and maybe horse, occurred at this time, and pollen shows that the forest extended up to the Arctic coast." About 75% of the artifacts are made from prepared flakes struck from prepared discoidal cores; they are all unifacial and usually show evidence of a well-prepared striking platform. Types include large crude angle and corner burins, hooked gravers, scrapers, knives, a few end scrapers, spoke shavers, and points that have lanceolate, tear-drop, or concave-based shapes. The other quarter of the artifacts from this complex consists of large plano-convex scrapers, bifacial choppers, ovoid bifacial knife blades, and bifacial lanceolate projectile points with large basal fluting.

The next succeeding occupation is known as the Flint Creek complex. Suggestions point to a fairly cold wet period which followed the last ice advance from the Hudson Bay region, and the remains indicate a quite different flint-working industry in this level. Among the artifacts found here at a place where "extinct superbison" were butchered are points of Plainview and Angostura-like type, crude burins, microblades, larger prismatic blades, and many bifacially worked fragments. Above the Flint Creek materials occurs a Denbigh-like horizon which bears plains vegetation pollen that suggests warm and dry climatic conditions. Animal remains of caribou, modern bison, and wapiti tend to support this evidence.

The stratigraphic series is next marked by 3 distinct ceramic horizons. The Firth River horizon contains cord-marked pottery and an artifact complex that is very similar to Cape Denbigh materials. Next above comes the Buckland Hills complex with dentate stamped pottery and some grooved ware. Its stone inventory includes many burins and retouched burin spalls, a few microblades, many side blades, and some new kinds of stemmed and notched projectile points. The still later Joe Creek horizon bears grooved pottery, some doubtful microblades, many burins with ground surfaces, and numerous bone tools, some of which have gouged holes in them. MacNeish remarks that "there are no real marine-adapted Eskimo tools" in this level.

The uppermost 3 strata of the site are apparently all attributable to Eskimo cultures. The earliest of these carries some Norton check-stamped ware and ground slate, but no burins or microblades. "The next had Barrow Curvilinear in it and some open-socketed Thule harpoons. Not much change in vegetation or fauna is apparent in these horizons except the occurrence of musk ox and some moose bones, and occasional whale or seal bone."

SOUTHAMPTON ISLAND. William E. Taylor, of the Canadian Museum of Natural History, continued work here during the last summer, and it is hoped that a brief report of his finds may be included in the next issue of "Notes and News."

OLD COPPER CULTURE. Albert C. Spaulding, University of Michigan, who claims to be now the southernmost of Arctic archaeologists, argues strongly that his favorite culture, Old Copper, "is indeed a suitable subject for a résumé" in our category. I agree, and gladly pass on certain results of his field work in Michigan's Upper Peninsula during the summers of 1953, 1955, and 1956. The most important news concerns an Old Copper burial excavated within the city limits of Menominee. The badly decayed skeleton of an adult male, flexed on its side, was located under a heavy deposit of red ochre in a pit 4 feet deep. Grave furnishings included 2 dog skeletons, 4 copper-pointed arrows or darts, a perforated lynx scapula, and a bundle of other artifacts, possibly an

arrow-maker's kit. This bundle contained, among other items, retouched flake scrapers, one of them an end scraper, utilized beaver teeth, a small flint knife, 2 small side-notched flint points and a longer corner-notched flint point, an antler shaft wrench, and several copper artifacts.

Spaulding's appraisal follows: "The antler of which the shaft wrench was made has been identified as caribou, and, surprisingly enough, Barren Ground caribou. . . . Even Woodland caribou would be somewhat out of place so far south as central Green Bay. The dogs are large animals; in length of carnassial (supposed to be a reliable indicator), they clearly fall in the group of Eskimo dogs and the larger of the two exceeds the mean of Greenland dogs, the largest of the Eskimo groups. On the assumption that the antler was obtained from a local animal, it would appear that the burial dated from a markedly colder period prior to the Xerothermic of some 3500-4000 years ago. This dating is consonant with the radiocarbon dates of about 5500 and 7500 years ago for the Oconto, Wisconsin, cemetery. The large dogs, presumably having Arctic affinities, add some weight to the hypothesis that Old Copper together with the related Laurentian and Red Paint cultures is a representative of an ancient boreal forest culture type which formed at least a part of the ancestry of Eskimo culture."

Assembled by ELMER HARP, JR.

PACIFIC COAST AND GREAT BASIN

WASHINGTON. The archaeological salvage surveys and excavations at The Dalles Reservoir area by the Universities of Washington and Oregon, under contract with the National Park Service, have come to a close, except for Mr. Butler's supervision of the Oregon Historical Society's excavation of Wakemap Mound. The Over and Lois sites on the Washington side of The Dalles were completely excavated and, according to Butler, 3 major cultural strata were observable. This summer's work was the last before the reservoir begins to flood. The Corps of Engineers has contracted to salvage a representative number of the petroglyphs which will be inundated by the reservoir.

Douglas Osborne of the University of Washington reports that arrangements are being made with the Grant County Public Utility District for excavations in the Priest Rapids reservoir on the middle Columbia. This work will begin next summer. Warren Caldwell, who began excavation in Hell's Canyon reservoir, has taken a position at Lincoln with River Basin Surveys. George Coale completed the Hell's Canyon excavations.

Arrangements have been made by the National Park Service for Clayton Denman of the University of Washington to conduct salvage excavations in Olympic National Park at a site at Toleak Point which is being destroyed by wave action.

A contract has been executed between the National Park Service and the State College of Washington to perform archaeological salvage operations at the Ice Harbor Reservoir Project on the lower Snake River. Excavations will be under the direction of Richard Daugherty.

IDAHO. A museum has been opened in the library building of Idaho State College at Pocatello, Idaho. The anthropology section of the museum along with much of the general planning of the entire museum has been the work of Sven Liljeblad.

UTAH. The archaeological activities of the University of Utah during the fall of 1956 have consisted primarily of work on manuscripts. Field work has been restricted to brief trips for the Utah Statewide Archeological Survey into Uintah, Emery, and Box Elder counties. One of these trips had as its primary objective the evaluation of the geological situation at Thorne Cave which has occupation levels buried in very thick alluvial deposits.

NEVADA. The Nevada State Museum joined with the National Park Service in sponsoring a study of prehistoric cultural patterns in the southern Great Basin. The work, carried out by Dick Shutler, Jr., contributed several radiocarbon dates. The Museum also collaborated with the Western Speleological Institute in investigations of the caves and lake history of ancient Lake Lahontan. The Museum's "mobile unit," a 35-foot trailer, visited approximately 33,000 Nevada school children in about 200 schools showing exhibits of Nevada archaeology.

CALIFORNIA. The University of California Archaeological Survey has been engaged in salvage excavations in various parts of Central California. A leveled site near Antioch yielded 26 burials of particular importance because the single phase cemetery marks the transition from the Middle Horizon to the Late Horizon. Traits of early Phase 1 of the Late Horizon predominate, and include flexed burial, diagnostic shell bead and ornament types, harpoons, and large projectile points with incipient serration. Middle Horizon traits are represented by extended burial, earplugs, and fish spears. Collections have also been made from 2 recently leveled Middle Horizon sites in Contra Costa and Merced counties. Salvage excavations are continuing in the Monticello Reservoir, east of Sacramento. The UCAS has sampled an historic cemetery of the Spanish period, and work is continuing on several sites under the direction of R. H. Reeve and B. Arnold of Sacramento State College.

Sacramento State College continued excavations at the Roeder site, south of Sacramento, until this large mound was leveled. The site was stratified, with remains of the Late Horizon and at least 2 phases of the Middle Horizon. Analysis of the large collection should prove instrumental in the unraveling of cultural changes within the Middle Horizon.

The Great Basin Archaeological Conference will hold the next meeting on August 26-27, 1957, at San Francisco State College. The program will concentrate on Great Basin chronology and related problems.

M. R. Harrington reports that the Southwest Museum is undergoing extensive renovation in preparation for the 50th Anniversary of the institution.

The Department of Anthropology at University of Southern California in cooperation with the Archaeological Research Associates is excavating at the Hugo Reid adobe in the Los Angeles State and County Arboretum in Arcadia. The adobe is to be reconstructed as it was about 1840 by the State Division of Beaches and Parks.

The 1956 field season of the Western Speleological Institute in Lake Lahontan, Nevada, has resulted in 6 additional radiocarbon dates by 2 laboratories (to be released soon) and the collection of many more radiocarbon specimens now in process of measuring by Lamont. Most of the 1956 field season was devoted to geomorphic problems which, in turn, will reflect upon the archaeological material. Cooperating in the study were George F. Carter, of Johns Hopkins University, who did archaeology on open sites and collected soil samples of lake sediments, Oliver Schaefer and Ray Davis, of Brookhaven National Laboratories, who made collections of material for chlorine 36 analysis, and Wallace S. Broecker and Bruno Giletti, of Lamont Geological Observatory, who made collections of radiocarbon material and tritium samples for age determination.

Charles Rozaire has joined the Santa Barbara Museum of Natural History as collaborator and will study and describe basketry from the Winnemucca Caves. John M. Thompson has joined the staff as Assistant Curator of Archaeology, replacing Richard S. Finley who resigned to take a position in industry. Philip Orr will join K. O. Emery of the University of Southern California Department of Geology in geomorphic studies of the submarine geology of the Santa Barbara Channel. Orr hopes that this study will contribute information on land connections between the mainland and Santa Rosa Island which allowed the dwarf mammoth to reach the island.

Archaeologist Paul J. F. Schumacher was assigned to the Region Four office of the National Park Service in San Francisco and entered on duty November 4. He conducted a week's exploration excavations at the traditional site of Lewis and Clark's Fort Clatsop near Astoria, Oregon, during December. Two fire pits were located but none of the remains pointed definitely to the Lewis and Clark period.

Assembled by R. D. DAUGHERTY

SOUTHWEST

ARIZONA. The Department of Anthropology at the University of Arizona and the Arizona State Museum will jointly sponsor the Twelfth Annual University of Arizona Archaeological Field School at Point of Pines on the San Carlos Apache Indian Reservation from June 14 to August 9, 1957. The school will be supervised by Raymond H. Thompson, who will serve as Acting Director.

William W. Wasley, Archaeologist, Arizona State Museum, has been engaged in salvage archaeology at the site of the Franciscan Mission of San Jose del Tucson as well as developing the program of highway salvage archaeology in Arizona.

Southwestern archaeologists are well acquainted with salvage archaeological work, including state and federal highway, pipeline, and river basin salvage programs. The Museum of Northern Arizona has given active aid to all of these programs, and in December added what may be a new variety — a forest salvage program. The increasing amount of juniper clearance in the Southwest has resulted in the accidental destruction of many sites. Both the weight of caterpillar tractors and the uprooting of trees have played havoc with ruins that had standing walls or large piles of wall debris. The Supervisor of the Coconino National Forest and the Museum staff are now cooperating to save such sites for the future. When a contract for clearing is signed, the Forest Service notifies the Museum. The section to be cleared is then surveyed by a forester and the Museum archaeologist, David Breternitz, who tape the sites to be bypassed by the tractors. A few days thus spent each year will save many promising sites from mutilation.

This summer associates of the Museum of Northern Arizona will complete 2 archaeological surveys related to the Glen Canyon Dam project and the eventual flooding of large areas around the Colorado and San Juan rivers. William C. Miller will complete his intensive archaeological survey of Navaho Canyon in May. Work in the upper two-thirds of the canyon was completed in 1954 and 1955. Gene F. Foster will intensify her survey of the Colorado begun several years ago. She will work in the Colorado and its side drainages nearest the damsite. A report on nearly 100 sites so far studied will be published this year by the Museum of Northern Arizona.

Reprocessing of the Tully H. Thomas Collection from the vicinity of Concho, Arizona, has disclosed the following additions to the lithic material already described for the area: grinding tools, pulper planes, lamellar flake knives, ground-edge scrapers, and notched flakes. A complete description of these tools will appear in a forthcoming issue of *Plateau*. The grinding tools, especially, are important for typological and economical comparison of the Concho culture with other early man cultures in the Southwest.

At the Amerind Foundation, a plan is under way to establish a predoctoral research fellowship that will permit any anthropology department that offers a doctorate to recommend a doctoral candidate for research on the specific problems of Pimería Alta. This program should be in effect by 1957. At the Foundation, displays for a new archaeological hall will include materials from Coclé, the Tarascan area, Nayarit, Colima, and Casas Grandes. It is hoped that these comparative groups of material will assist in formulating studies of relationships between the early Red-on-brown cultures of Pimería Alta and perhaps the Tarascan areas.

Paul S. Martin and John B. Rinaldo of the Chicago Natural History Museum have established new permanent field headquarters in Vernon, Arizona. In an extensive reconnaissance from Vernon east to Springville and north to St. Johns, ceramic and nonceramic sites were found that represent several periods of occupation and

appear to parallel the sequences of other Mogollon cultures southeast and southwest of Vernon.

At Arizona State College at Tempe, a Classic period Hohokam site is being excavated on land purchased by the College for construction of new buildings.

NEW MEXICO. Since the beginning of September, 7 sites have been excavated under the cooperative Highway Archaeological Salvage Program of the Museum of New Mexico and the New Mexico State Highway Department. Early in September, Stewart Peckham excavated 2 McElmo phase pueblos near Waterflow, on U.S. 550. Aside from some architectural differences in the 3 kivas dug, the most important item noted on the sites was the persistence into Pueblo III times of La Plata Black-on-red, usually considered a Pueblo I-II pottery type. In November, Edward Dittert dug 2 Wingate phase sites on U.S. 66, near Thoreau, New Mexico. One site of 5 rooms (no kiva was found) showed a marked differentiation of room function, that is, dwelling, grinding, and storage rooms, and also yielded significant amounts of Forestdale Smudged, a pottery type that, according to Gladwin, had died out by the Wingate phase. The other site was a rock outline of a 2-room farm dwelling apparently having only a brush superstructure — a house type hitherto undescribed for the phase. Peckham also excavated a 2 room jacal site and a kiva near Taos, both of which produced Taos Black-on-white and Taos Incised as the principal pottery types.

In the Pine Lawn Valley, on U.S. 260, the excavation of a step-entry Pine Lawn phase pit house revealed a centrally located hearth from the rim of which radiated 2 short but definitely intentional ridges or nubbins in a manner reminiscent of ridges found in early Anasazi pit houses.

By late summer, Dittert completed a site survey of the South San Juan Division of the Shiprock Irrigation Project and had also surveyed the damsite, access road, siphon route, and part of the reservoir area of the Navaho Dam Project. To date, 103 sites have been located, and when complete the survey will cover the region between Rosa, New Mexico, and the New Mexico-Arizona Boundary. The results of the survey will be the basis for an archaeological salvage program concerned with the excavation of sites to be inundated or leveled by the 2 construction projects. This work is being done under an agreement between the School of American Research and the U.S. National Park Service. Test excavation of 2 sites of the Gobernador phase (Refugee period, about A.D. 1700) in the damsite area has pointed to at least one direction which future salvage excavations will take, inasmuch as they may provide new data concerning the early historic period in that area. The 2 sites, a forked-pole hogan and a ramada structure, were found with late-period pottery types and plain gray Navaho culinary pottery that, in sherds, differs from the earlier Rosa Gray only in averaging somewhat thinner.

COLORADO. The University of Colorado has acquired the library and private archaeological collection of the late Earl H. Morris. These acquisitions will greatly strengthen the undergraduate and graduate programs in Southwestern and Middle American archaeology. The library has an excellent coverage of the Southwest and considerable material on Middle America. Also included are a number of unfinished manuscripts and numerous field notes, which the staff and graduate students hope to organize in the near future. The archaeological collection, when added to the specimens already in the University Museum (most of which were collected by Morris) constitute an outstanding collection of Anasazi material.

Assembled by E. B. DANSON

PLAINS

NEBRASKA. In November, Richard G. Forbis and Robert Neuman worked at Signal Butte, looking for material for radiocarbon dating. They were able to collect good samples from Signal Butte I and II, even though most of the cultural zones on the butte have been destroyed by previous excavation and enthusiastic pot hunting.

The 14th Plains Conference met in Lincoln on November 22-24, with Richard P. Wheeler as Chairman. This was the 25th anniversary of the Conference. There were 4 major sessions plus an evening business meeting. Approximately 60 persons registered. Increased activity in the Plains was reflected in the fact that 2 entire sessions were devoted to 10-minute field reports, whereas in past Plains Conferences one session has usually been enough. The 2 field report sessions were chaired by E. Mott Davis and Reynold J. Ruppé, Jr., and the work reported therein has for the most part been summarized in these columns. Mention should be made, however, of 2 reports from Missouri, one in which Robert A. Marshall described the use of a ditching machine in testing a large site in the Table Rock Reservoir Area, and one by Robert T. Bray describing a highly successful Sunday open house held by the Missouri Archaeological Society. There was also a good deal of discussion of sampling techniques in Middle Missouri sites, precipitated by a field report by David A. Barreis.

Charles H. Lange was chairman of the third session, which was devoted to formal papers, as follows: M. K. Elias, "Known and Unknown about the Ancient Prairie"; W. J. Mayer-Oakes, "The Plains Archaic Concept"; W. R. Wood, "The Redbird Focus"; F. Hadleigh-West, "The Bayou Manchac Midden"; E. I. Fry, "Skeletal Remains from the Wallace Mound, Nebraska"; and M. E. Tong, Jr., "Why Dig Up Dead Indians Anyway"?

The final session, with Frank H. H. Robert, Jr., in the chair, was a symposium on "Cultural Relationships Between the Plains and Surrounding Areas in Historic and Prehistoric Times." Six papers were presented, and each was followed by spirited discussion from the floor. Jesse D. Jennings spoke on Plains-Great Basin relationships; Donald J. Lehmer and Charles H. Lange spoke on different aspects of historic Plains-Southwestern relationships; J. Charles Kelley discussed the Plains-Mesoameri-

can periphery; Robert E. Bell spoke on Plains-Caddoan relationships; and E. Mott Davis discussed pre-Altithermal relationships between the Central Plains and neighboring areas. At the business meeting, Wesley R. Hurt was elected Chairman of the 15th Plains Conference, which is to be held jointly with the American Indian Ethnohistoric Conference at Lincoln in 1957. After the business meeting there were 3 illustrated anthropological travelogues on Polynesia, by Robert E. Bell, Carlyle S. Smith, and Edward I. Fry.

KANSAS. At the Toronto Reservoir area in southeastern Kansas, an archaeological survey has been carried out for the River Basin Surveys. This reservoir is to be on the Verdigris River in Greenwood and Woodson counties, in an archaeologically unknown area. The survey was carried out on weekends in September and October, 1956, by Alfred Johnson, a senior at the University of Kansas, and 2 others. A previous brief survey had been made in 1953 by E. H. Moorman. Thirty-five sites are now known in the reservoir area, representing Upper Republican, Plains Woodland, Hopewellian, and nonceramic complexes. Johnson tested 2 sites, in each of which an Upper Republican component appears to overlie a Keith Focus (early Central Plains Woodland) component. Seven sites are being recommended for further investigation. Work here should prove interesting, since it may shed light on relationships between the Central Plains and the Caddoan area.

OKLAHOMA. On October 15, 1956, the Oklahoma Archaeological Salvage Project was established at the University of Oklahoma. Its purpose is primarily highway salvage but any site threatened with destruction within the state comes within its scope. The project is under the general direction of Robert E. Bell. Its full-time director is James B. Shaeffer, who has been appointed Archaeologist in the Department of Anthropology. The project got off with considerable initial publicity due to a salvage operation undertaken the day after its establishment. The ditching machine of an oil company bisected an Indian burial mound in a field near the North Canadian River on the northeast outskirts of Oklahoma City. Due to the proximity to Oklahoma City plus the fact that 18 burials, some accompanied by Spiro type ear spools, were uncovered in a restricted area, visitors, TV newsreel cameramen, and reporters swarmed over the site for several days. The ear spools, incidentally, are identical in design to Spiro types and represent a new western boundary for their distribution.

TEXAS. The annual meeting of the Texas Archeological Society took place at Waco on November 2 and 3 with about 175 persons in attendance. Hosts were the Central Texas Archeological Society and Baylor University. Twelve papers were read at the regular meeting, the subjects ranging through paleoclimatology, protohistoric archaeology, survey reports, and excavation reports. Nine of the papers were by amateurs, 3 by professionals. A striking upsurge in amateur interest in archaeology in Texas was indicated by reports of local society activity. R. King Harris of Dallas was elected President; Henry F. Sturgis of Austin, Secretary-Treasurer; and E. Mott Davis of the University of Texas, Editor of the annual *Bulletin*. The Society passed unanimously a resolution in favor of legislative action to set up a State Archeological Commission and the position of State Archaeologist.

Assembled by E. MOTT DAVIS

NORTHERN MISSISSIPPI VALLEY

ILLINOIS. The Illinois Archaeological Survey met at Urbana on December 15 to discuss the highway salvage program. The survey, under the presidency of John C. Mc.Gregor, has received excellent cooperation from the Illinois Division of Highways. It is hoped that the salvage program will be well under way shortly after the first of the year. The first stage, that of site survey in pertinent areas, will be carried out by the cooperating institutions of the Illinois Archaeological Survey. A tabulation of all the archaeological sites known in the state of Illinois, and a concurrent correlation of survey records in the different institutions in the state, is being carried out by Elaine Bluhm at the University of Illinois.

MINNESOTA. Lloyd Wilford and a crew of 3 students spent a month on an island campsite in Lake Benton, Southwestern Minnesota. Cultural material was found at a depth of 3 feet, which is unusually deep for Minnesota. It is a Late Woodland site, very rich in fish and bison bones. Most of the latter were bones of the front quarters, indicating that the bison were killed elsewhere and portions brought to the island. Some Middle Woodland pottery was found in the lower layers. Intrusive sherds were Oneota, in the upper levels, and one simple-stamped sherd typical of the Earth Lodge cultures of the Missouri River. Lacking were catlinite and Great Oasis sherds, though the pipestone quarry and the Great Oasis type site are both very near.

Three weeks were spent at the Smith Mound group on the Rainy River at Laurel. Mound Four of the group had been dug in 1933 and was the type site of the Rainy River aspect. Mound Three of the same group was dug this year as a salvage operation, as the river was beginning to wash it away. It proved to have fewer burials than Mound Four, which was a little smaller, but it yielded 2 excellent examples of disarticulated burial, more convincing than any encountered in the earlier mound.

Two weeks were spent at an Oneota site on the St. Croix River, 9 miles north of Stillwater, the most northern site of this culture in Minnesota as far as known. It was interesting in that it lacked the evidence of agriculture, such as storage pits and scapula hoes, found at all previous Oneota villages. It was particularly rich in fish bones, clam shells, and deer bones. Arrowheads and fishhooks were more numerous, and end scrapers less common, than in the sites studied previously. It is concluded to be a fishing and hunting camp of Oneota peoples who lived farther south on the Mississippi River.

During the past summer the Science Museum of St. Paul completed a 3 year program of archaeological salvage

in the Spring Lake area. A 16 week field season saw the museum crew under the direction of Elden Johnson complete work on 5 sites. Three sites were in the Late Woodland period and give a good sample of Woodland cultures distinct from the Kathio and other more northern foci. The remaining 2 sites were the Sorg site, partially excavated previously, and the Schilling site, excavated for the first time this year. This latter site proved to be the richest in the Spring Lake area and produced the earliest ceramic material yet found in the region. The early ceramic material is Hopewellian and apparently precedes both the Sorg and Howard Lake manifestations. Progress has also been made in the study of trade beads and their distribution. A large catalog of trade beads, classified according to physical characteristics of the beads and also according to temporal-spatial relationships has been completed. The Museum is anxious to receive specimens of trade beads excavated in documented historic and prehistoric sites so that this catalog and the temporal-spatial ranges of particular bead types may be expanded.

Missouri. The University of Missouri, with the aid of a grant from the National Park Service, continued salvage archaeology the year around in the Table Rock Reservoir area; completion of the survey brought the total number of site locations to 840. Tests and excavations were conducted on 9 shelters, 12 open campsites, and one rock-lined grave site, making a total of 42 sites investigated in the area thus far. Field parties worked throughout the summer and fall under the direction of Carl H. Chapman, Robert T. Bray, and Richard A. Marshall. Bray has left the University staff and moved to Effigy Mounds National Monument, MacGregor, Iowa, as Archeologist with the National Park Service. Another grant of $9500 from the National Park Service, Region Two, in August will extend the field work in Table Rock until the fall of 1957. Intensive work will take place during the summer months on a ceremonial mound, burned house sites, and shelters near the mouth of James River. A small ditchdigger was added to the equipment for testing large terrace sites. Its operation has been very successful and the machine has been especially useful for locating buried sites and burned house sites. It is planned to continue tests with the digger on 10 sites.

An "Open House" was held at a shelter site near Golden, Missouri, at the beginning of the summer to explain the work to the public; it was attended by more than 5000 people. The Ozarks Chapter of the Missouri Archaeological Society, 3 Boy Scout Explorer troops, the Sheriff of Barry County and his deputies, and visiting archaeologists aided in handling the crowd and explaining the excavated materials. This type of "Open House" held at the digs appears to be a very successful means of obtaining good public relations for archaeology.

J. Mett Shippee, of the University of Missouri staff in archaeology, spent the spring in surveys in 4 different counties and then supervised the excavation of Research Cave in Callaway County during the summer and fall. Members of the Missouri Archaeological Society worked with Shippee and aided the project with a grant of funds to the University. It is planned to reopen the excavation of the cave in the spring.

In June and July, Richard O. Keslin, of the University of Missouri, and students participating in the summer field session, excavated one of the elongated mounds described by Bushnell (1914) and Adams (1941). A site survey revealed several previously unreported villages and salt pan sites and provided an abundant supply of surface-collected pottery. On the basis of material excavated from the mound, the time of construction appears to be earlier than had been anticipated. Only 2 types of pottery were included in the mound fill, Baytown Plain and Mulberry Creek Cord Marked. Since more than adequate samples of charcoal were obtained, analysis of the radiocarbon content should provide some information on the temporal distribution of these pottery types in the area. The 1957 field session will be located in the same area and current plans call for excavation and extensive testing of several village and salt pan sites.

Wisconsin. Arthur Niehoff of the Milwaukee Public Museum excavated Woodland mounds in Dodge County, Wisconsin. Robert Ritzenthaler of the Milwaukee Public Museum assembled for photographing and report in the December issue of the *Wisconsin Archaeologist* all specimens taken from the important Reigh Site (Glacial Kame culture) since its initial excavation in 1953.

Assembled by M. L. Fowler

NORTHEAST

Massachusetts. The work of the Cohannet Chapter of the Massachusetts Archaeological Society at the Wapanucket site on Lake Assawompsett in Middleboro, Massachusetts, continues to provide significant information. Maurice Robbins reports that a study of the data and materials from the 1956 excavations indicates that the 3 lodge floors discovered are associated with a preceramic component. If so, these will be the first features of such antiquity to have been found in the area. The presence of atlatl weights associated with stemmed points, partly grooved axes, adze and gouge blades, roller pestles and fragments of steatite vessels, as well as the absence of large triangular points, pottery, and trade goods point to the above conclusion. A still older horizon at this site is suggested by the finding of one complete fluted point and the basal section of a second. A large number of chips of jasper and flint, some of them retouched, have also been found along the lake shore at Wapanucket. These chips have been identified as having come from eastern Pennsylvania and New York quarries.

New York. Late in September, 1956, earthmoving machinery opened a burial ground on the Morrow site near the village of Honeoye in Ontario County, New York. This area of several acres is being prepared for building lots by the Honeoye Lake Development Corporation. The site lies on the northeast side of Honeoye Lake and has been known as the possible location of an historic Seneca village. The burials were first investigated

by Harry L. Schoff and Charles F. Wray, members of the Lewis H. Morgan Chapter, New York State Archeological Association. During subsequent salvage operations, Alfred K. Guthe and Marian E. White represented the Rochester Museum of Arts and Sciences and William A. Ritchie, the New York State Science Service. More than 30 burial pits were recorded within a 50 foot square. These contained cremations and flexed burials, in some cases both. Artifacts had been placed with some of the burials, including copper beads, cache blades, a tubular pottery pipe, gorgets, reworked birdstones, side-notched projectile points, net sinkers, and the charred remains of a net. A few potsherds were found on the surface following the first activity of the earthmoving equipment. This burial plot provides further evidence of the late Early Woodland occupation of western New York. The artifacts appear to be associated with the Point Peninsula 2 culture. The net fragments may prove to be the earliest yet recovered in the northeast. Associated charcoal has been submitted to the University of Michigan for radiocarbon analysis.

Julius Lopez reports that his research in the New York City region leads to the recognition of 4 types of pottery with cord-marked interior surfaces. These occur on the coast. He has described these as follows: (1) Complete Interior Cord-Marked, with both surfaces completely covered with cord impressions like Vinette 1; (2) Modified Interior Cord-Marked, revealing an obvious attempt to remove the interior cord-marks by brushing or wiping while the clay was still wet; (3) Decorated Interior Cord-Marked, which bears exterior designs, usually dentate; and (4) a pottery type, known from one vessel, which has a mammiform appendage reminiscent of some Adena ceramics. This is particularly significant since in central New York State Vinette 1 is the only type which has been described as exhibiting cord-marked interior surfaces. It has generally been assumed that coastal examples were inspired or diffused from the north. However, pottery similar to the Complete, Modified, and Decorated types has recently been reported from the Delaware Valley by Dorothy Gross.

PENNSYLVANIA. John Witthoft's work on the Susquehannock site sequence continues, with the first attempt at a general synthesis in press in the *Bulletin of the Archaeological Society of Maryland*. Although Witthoft's analysis of many of the Pennsylvania State Museum's collections is not completed, and despite inadequate data from certain key sites, it is apparent that the so-called Andaste sites of the northern Susquehanna are ancestral to later historic Susquehannock sites in southern Pennsylvania, and that MacNeish's suggestions regarding Susquehannock-Cayuga-Mohawk cultural relationships are valid.

Two fluted point surveys are being conducted in Pennsylvania. One is by Ronald Mason, a graduate student at the University of Michigan, and the other is by W. Fred Kinsey of the Pennsylvania State Museum. Mason is dealing with points from the Delaware Valley while Kinsey's work is concerned with those from the Susquehanna Valley. A preliminary analysis of the fluted points from these areas indicates that the paleo-Indian experimented with and used a wide range of lithic materials for projectile points. The series includes rhyolite, quartz, and the fine grades of cherts, flints, and jaspers. The most frequently used material is the blue-gray Onondaga chert from the outcrops in western New York. Some value must have been attached to the finished product since at least 3 points show evidence of subsequent rechipping, and reshaping. This reworking probably occurred after the point was damaged or broken due to usage.

Last summer and fall while excavating at the Oscar Leibhart Site in York County, members of the Lower Susquehanna Chapter of the Society for Pennsylvania Archaeology in cooperation with the State Museum, explored the floor plan of one Susquehannock longhouse and found a second longhouse. Apparently this area is the location of a large Susquehannock Village of 1650 to 1675. Although the local chapter and the museum would like to continue excavations on the village site, plans for this work are currently being held in suspension.

H. Geiger Omwake, of the Governor Bacon Health Center, Delaware City, Delaware, is working on the problem of the dates and distribution of various type markings found on kaolin trade pipes. These manufacturer's marks, like the Tudor rose, the Gouda goblet, the fleur-de-lis, and others found on the stem, heel, and bowl, will be an important dating device for historic sites. Also they may reveal much about trading patterns during the Colonial period. Omwake would appreciate reports from anyone knowing of sites that have produced kaolin pipes.

Catherine McCann has been appointed Curator of the Tioga Point Museum at Athens, Pennsylvania.

Jacob W. Gruber of Temple University reports that he worked on a site along the Delaware River just north of Riegelsville, New Jersey. He was aided by Ronald J. Mason and members of the Southeastern Chapter of the Society for Pennsylvania Archaeology. Preliminary study indicates this is a single component of the Late Woodland period.

Assembled by A. K. GUTHE

SOUTHEAST

ALABAMA. Carl F. Miller reports that a joint Smithsonian Institution-National Geographic Society expedition excavated extensively in Russell Cave near Bridgeport, Alabama, during April, May and June of 1956. The lowest level reached, 14 feet from the surface, has been dated by the Lamont Radiocarbon Laboratory as 8160 ± 300 years ago. The top 5 feet yielded limestone tempered pottery wares known in considerable detail from Woodland horizons within the Tennesse Valley and adjoining areas in northwestern Georgia. The next 8 feet contained various phases of the Archaic, each with its distinctive projectile types and bone tools. The lowermost level gave hints of the presence of early man. Addi-

tional work will be started in the summer of 1957 in hopes of reaching the very bottom of the cultural deposits.

FLORIDA. Florida State University: Survey activities of the Department of Anthropology have located 2 relatively untouched mounds in Jefferson County. They both seem to be late Weeden Island or intermediate between Weeden Island and Fort Walton. They are rather distant from large bodies of water which suggests a revision of the concept that Weeden Island culture was oriented toward a coastal or riverine environment. Analysis of the material collected at Fort San Luis during the summer school excavations has revealed a musket cock which seems to date about 1600, some 50 years before the known settlement of the site. This is a rather clear example of the fact that arms are often of older dates than the actual occupations of the sites where they are found. New World garrisons clearly used out-of-date arms.

Florida State Museum: Ripley P. Bullen, with Frederick W. Sleight of the Central Florida Museum, made a stratigraphic test during February, 1956, of the Castle Windy site a few miles south of New Smyrna Beach. Seventeen feet of pottery bearing shell midden were found, and samples for radiocarbon dating were secured. It is hoped that pottery analysis with a radiocarbon date will help settle chronological problems in the area.

GEORGIA. Lewis H. Larson, Jr., for the Georgia Historical Commission, has recently cleaned up the 2 largest Etowah Mounds, built an in-place exhibit over a late house pattern in the village area, and has installed exhibits centering around the Southern Cult material from Mound C in a temporary museum building. Larson has finished stripping the final cap off the base of Mound C. He reports that a series of ceremonial graves, with Southern Cult artifacts, intruded through this cap. Their bases lay between the outer edge of the next-to-last cap and a palisade which encircled the mound. Pottery with the burials was largely plain or negative painted, and not precisely dateable. All fill sherds however are of the Wilbanks series. The list of finds included the following: shell gorgets with eagle warriors, copper cymbal badges, a large copper plate with open eye design, a copper gorget with an embossed cross, a copper gorget with an excised triskele, large flint blades, stone statuettes, pierced celts, some cloth, and a wooden rattle. Some excavation in the next layer, which has stone box graves, has produced cedar masks, a mica headdress, and a stone ear spool.

Joseph R. Caldwell, for the Smithsonian Institution River Basin Surveys and the Georgia Historical Commission, is excavating at the Tugalo site near Toccoa. Several weeks work in a large mound have indicated that it is a stratified temple mound structure, with a number of Etowah periods and Historic Cherokee represented.

A. R. Kelly of the University of Georgia and a group of students are doing salvage work on a group of stone mounds in the Buford Basin. A group of 15 structures was uncovered during clearing operations. Survey activities include work on the Fort Benning reservations, where the commanding officer reports a number of mounds and village sites. Some survey is planned for the spring on stone mounds and linear structures near the Eatonton Eagles. Work at the Etowah site by the University Summer School is planned for the summer of 1957.

LOUISIANA. The 13th Southeastern Archaeological Conference met at Louisiana State University on November 30. Topic of the conference was the status of the lower Mississippi Valley in Southeastern prehistory. The conference concluded that the Lower Mississippi Valley has been largely marginal in the past as now.

NORTH AND SOUTH CAROLINA. W. C. Haag has for several summers been conducting coastal surveys for the Coastal Studies Institute. Haag reports that he did not find any evidence of the lost colony, but was able to develop a cultural sequence. In 1956 the survey was extended from the Neuse River to Charleston, South Carolina. Haag now believes that Wilmington represents the coastal terminus of the prehistoric Mason-Dixon line. The culture most strongly represented in the area is Deptford, with a very heavy representation of Horse Island-Stallings Punctate. In the summer of 1957, the survey will extend to the mouth of the Savannah River and perhaps to the Altamaha, with excavation at selected sites. The remaining portion of the Bilbo site will be excavated and one of the shell rings in the Savannah area, and perhaps some testing will be done at the Altamaha delta. Carbon specimens will be collected. The study is intended to relate the archaeology to recent coastal changes and tie it into the Melbourne interval and other late manifestations where possible.

TENNESSEE. T. M. N. Lewis reports that excavations at the Camp Creek site have been conducted weekends with a group of 5 Tennessee Archaeological Society members. The site covers about 6 acres with up to 5 feet of midden. Pottery includes Long Branch Fabric Marked, Candy Creek Cord Marked, Watts Bar Fabric Marked, and Watts Bar Cord marked, the latter 2 being quartzite tempered variants. Bone tools are especially abundant. They include pins with carved heads, engraved bone awls and antler handles, numerous handles made from bear humeri, an engraved antler comb, fishhooks, perforated and grooved bear and other canines, and numerous splinter awls. The site has also added considerably to knowledge of the cultural associations of such items as "pop-eyed" birdstones, bar atlatl weights with diagonal perforations, boatstones, biconical tubes, centrally perforated conch shell discs, and small sperical copper beads. An item of particular interest is the carbonized rear section of a switch cane arrow shaft showing the nock. Elsewhere in the state a minor amount of work is underway on the Overhill Cherokee site of Chilowee. The site contains a Dallas component too. The substructure mound appears to be plated with large river rocks and to contain a number of Dallas stone box graves. One grave pit in the village area, covered with stone slabs, yielded a total of 11 pottery vessels, three of which are double vessels.

VIRGINIA. At Colonial National Historical Park work continues on a general report of 23 years of archaeological investigations at Jamestown. The report is being compiled by John Cotter, Supervising Archeologist, with the cooperation of Curator J. Paul Hudson, a specialist in 17th Century arts and crafts. B. Bruce Powell, who has been assisting in the curatorial and archaeological work at Jamestown, has completed a correlation of all land tracts known at Jamestown and has related them to the archaeological base map.

Archaeological salvage has been underway at Yorktown, Virginia, in connection with extensive trenching for the laying of sewer pipes. The most important new fact to come to light is the existence of a kiln for the manufacture of stoneware pottery. Many saggers or vessels used to contain the objects being fired have been found, and it is possible that this evidence represents one of the earliest efforts at the making of stoneware in North America.

Assembled by W. H. SEARS

MIDDLE AMERICA

MEXICO. With the retirement of Ignacio Marquina, who for many years has directed the activities of the Instituto Nacional de Antropología e Historia de México, Eusebio Dávalos Hurtado now succeeds to the office, with Ignacio Bernal heading the Departamento de Monumentos Prehispanicos, formerly under Eduardo Noguera. Both incumbents are well known to American archaeologists and the news of their appointment is widely and cordially welcomed. We can be confident that archaeological work in Mexico, so ably supervised by their predecessors, will continue the progress it has made in recent years.

The major effort in Mexico is still being expended on the reconstruction of its larger sites, but minor investigations are yielding items of new scientific interest. Among these is the recent excavation by René Millon of a pre-Columbian irrigation canal, apparently of Postclassic date, in the Valley of Teotihuacán. Several other canals have been located, which Millon intends to test with excavations now being conducted under a grant from the National Science Foundation, and with the assistance of Peter Kunkel, graduate student of U.C.L.A. It is gratifying to note that pre-Columbian irrigation, which has been recently the subject of much heated debate, is being gradually brought out of the realm of speculation to be investigated in some detail.

We are also glad to learn, from a recent article in the *Bulletin of the Geological Society of America* by G. E. Hutchinson and others, that work on pollen profiles in Mexico continues to bring results. The recent investigations of Lake Patzcuaro, Michoacan, confirm and supplement the sequences worked out by P. B. Sears on Lake Texcoco, and though there are no direct archaeological associations, the climatic origin of the period of aridity in Classic times appears to be established more firmly.

In our July issue we reported briefly on the work of George E. Fay in northwestern Mexico in 1955. This work was part of a larger survey initiated in 1953 and centered in the state of Sonora. Plans are currently under way for a third general survey to be conducted in the area during the summer of 1957.

MAYA AREA. The Tikal project, under the auspices of the University of Pennsylvania Museum, is now in its second field season, directed by E. M. Shook of the Carnegie Institution. The field party is to include as archaeologists William Coe, of the Museum staff, and Vivian Broman. Morris Jones, of the U.S. Geological Survey, will initiate the mapping of the site with the assistance of Hazard, engineer from Guatemala, and Raley, graduate student in architecture at the University of Pennsylvania. Walwin Barr will join the party as photographer. Major activities will be centered on mapping and clearing and on completing the building of camp facilities. The problem of water supply remains to be solved, and it is planned to drill 3 wells and to establish a sawmill with power tools for clearing and building operations. Adequate laboratories and housing should be completed before the end of the season, which will last from about the middle of January, 1957, through the middle of May. Excavations will be limited largely to testpits to determine the nature and depth of deposits in different locations. More detailed studies will be made of one of the small assemblages of pyramids associated with stelae discovered last year. This will serve as a pilot project to establish a system of field and recording methods, later to be used in excavations of larger scope.

In April, 1956, Raul Pavon Abreu, of the Campeche Museum, led an expedition, sponsored by Mrs. J. P. Bullington of Texas, to Bonampak, where repairs were made on the roof and benches of the building with the murals in order to prevent their further deterioration.

Last season at Palenque under the direction of Ruz Lhuillier, with Heinrich Berlin assisting, began late and lasted well into October. Robert Rands excavated for pottery, and after a brief visit to the States was to return to Yucatán to study the collections.

While enjoying the popular sport of skindiving at Lake Atitlán, Guatemala, Enrique Salazar Liekens recently brought up from a depth of 70 feet below the surface a splendid specimen of an effigy incense burner. Numerous other vessels are reported to be in the lake. Will skindiving one day be placed on the curriculum of prospective archaeologists?

Assembled by TATIANA PROSKOURIAKOFF

LOWLAND SOUTH AMERICA

Substituting for Betty J. Meggars, who is in the field, I have been asked to discuss developments in the archaeology of the Antilles and Venezuela since the publication of the *Handbook of South American Indians*. This is to supplement Megger's previous discussion of recent developments in Amazonia and the Guianas (AMERICAN ANTIQUITY, Vol. 20, No. 4, pp. 410-1).

In the Antilles and Venezuela, the years since the *Handbook* articles were written (in 1942) have been

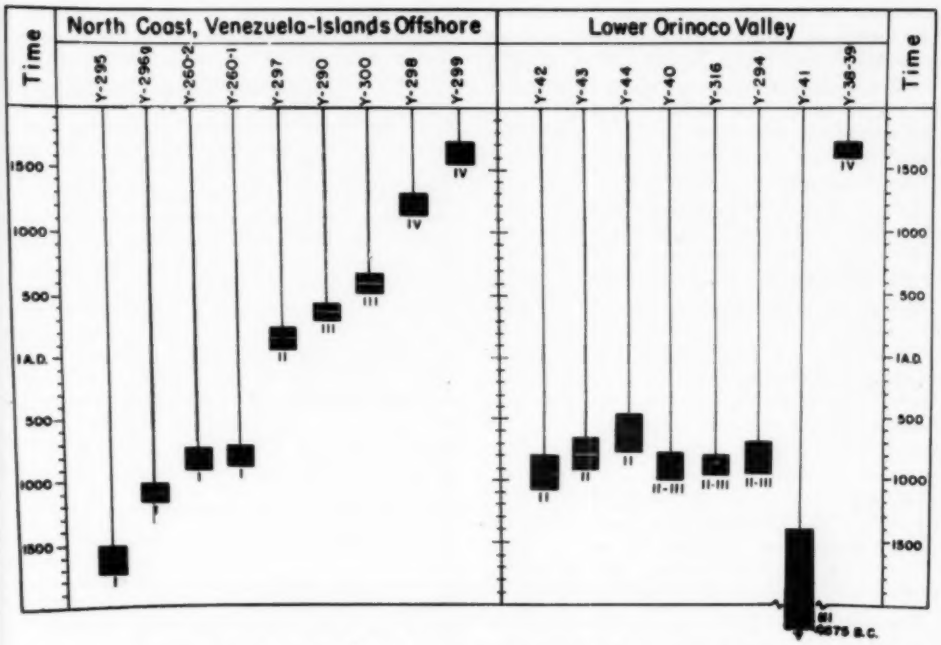

FIG. 1 [Notes and News]. Radiocarbon dates from Venezuela and Trinidad. The sample number is listed above each date, and its period on the relative chronology immediately beneath each date. The black rectangles indicate each date's range of variation.

marked by a continually increasing amount of research, both on the part of local archaeologists and of Americans. Among the more important recent excavations are those of Hahn in Cuba; Howard in Jamaica; de Boyrie Moya, Cruxent, and Goggin in the Dominican Republic; Alegría, Nicholson, and Willey in Puerto Rico; Vescelius and associates in the Virgin Islands; a series of French archaeologists in Martinique; McKusick in Dominica and St. Lucia; Bullbrook, Goggin, and myself in Trinidad; and Cruxent and I in Venezuela. Credit must be given to the Caribbean Anthropological Program of Yale University for sponsoring the greater part of this work and to the Wenner-Gren Foundation for Anthropological Research for grants which have made much of it possible.

Perhaps the most significant recent discovery is the El Jobo complex, found by Cruxent in northwestern Venezuela (AMERICAN ANTIQUITY, Vol. 22, No. 2, pp. 172-79, No. 4, p. 412). The first paleo-Indian-type lithic material to be found in tropical South America, it probably antedates the nonlithic, preceramic complexes of the Caribbean, which Alegría, Nicholson, and Willey (AMERICAN ANTIQUITY, Vol. 21, No. 2, pp. 113-21) have termed "Archaic."

The *Handbook* article on Antillean archaeology contained a first attempt to establish a relative chronology. This chronology has been confirmed and extended to Venezuela as a result of the subsequent excavations enumerated above. (It has also been correlated with the chronology established by Reichel-Dolmatoff for the Caribbean coast of Colombia, but that is beyond the scope of the present discussion.) Four major periods, numbered from I to IV, are recognized, with a fifth added in Trinidad and Venezuela to account for the numerous remains of the colonial period in those countries. Period I is the time of the preceramic, Archaic complexes mentioned above, while Periods II-IV are defined primarily in terms of pottery, except in the case of some Archaic survivals. The periods are based upon stratigraphic excavations in a series of strategic areas and upon cross-correlation of the local sequences thus established. Trade sherds and the occurrence of similar ceramic styles in adjacent areas provide the basis for cross-correlation.

Several attempts have been made to convert the relative chronology into absolute time. By applying the historic rate of refuse deposition in Puerto Rico to the prehistoric sites, I was able to obtain approximate dates of A.D. 1437 for the beginning of Period IV, 1193 for the beginning of Period III, and 929 for the beginning of Period II on that island. Subsequently, Douglas Taylor calculated a glottochronological date of about A.D. 150 for the spread of Arawakan language into the Antilles, and I applied this date to Period II of the archaeology on the

assumption that the Indians who introduced pottery and agriculture to the Antilles during Period II were the first Arakawans in the Antilles. Taylor's date of A.D. 150 is considerably earlier than the one of A.D. 929 based on the rate of refuse accumulation but seems preferable, since rates of accumulation are notoriously variable (see *International Journal of American Linguistics*, 1955, Vol. 21, No. 2, pp. 105-15).

As a check upon the glottochronological date, Cruxent, Goggin, and I submitted a series of charcoal samples to the Geochronometric Laboratory of Yale University for radiocarbon analysis. The results are shown in Figure 1 (taken from our report on the dates, to be published in the *Proceedings of the XXXIIth International Congress of Americanists*, Copenhagen, 1957). If we may accept the radiocarbon dates at their face value — except for sample Y-41, which is thought to have been chemically altered during analysis — they are consistent with the glottochronological date. They indicate that the first pottery-making, agricultural Indians (Period II in the figure) were moving down the Orinoco River shortly after 1000 B.C. and that these Indians spread to the north coast of Venezuela shortly before the time of Christ. If so, they may well have continued into the Antilles about A.D. 150, as suggested by the glottochronology.

Now that the first blush of enthusiasm for glottochronology and radiocarbon dating has worn off, some anthropologists have a tendency to regard them with suspicion. However, glottochronological and radiocarbon dates are certainly better than the guess dates so customary in archaeology, particularly when they are consistent with a previously established relative chronology. In the present instance, it will be seen that the radiocarbon dates for the north coast of Venezuela and the islands offshore agree perfectly with the relative chronology, but that the dates for the Orinoco Valley do not. This is not the place to discuss reasons for the latter discrepancy; I will only say that it can be eliminated without doing violence to such stratigraphic evidence as we now possess by moving the Saladero and early Barrancas styles, previously dated in Periods II and II-III respectively, back into the latter part of Period I.

In Megger's discussion of recent developments in Amazonia and the Guianas, she noted that the archaeology of these areas fails to substantiate Steward's Circum-Caribbean theory (published in the *Southwestern Journal of Anthropology*, 1947, Vol. 3, No. 2, pp. 85-107). This is also true of Venezuela and the Antilles. Steward had postulated a single center of ceramics and agriculture in the Andes and diffusion from this center into the Caribbean lowlands. Cruxent and I find instead that Venezuelan pottery and agriculture had a dual origin. As already noted, there seems to have been diffusion down the Orinoco Valley and out into the Antilles; the pottery here is Amazonian-like and the principal agricultural crop, bitter manioc. But there is evidence that Isthmian-like pottery was spreading eastward from Colombia along the Caribbean coast at about the same time, and we have reason to believe that the principal crop associated with this spread was maize rather than manioc. As Cruxent has pointed out to me, this tends to substantiate Sauer's hypothesis that there were 2 centers of New World agriculture, one of root crops in tropical South America and the other of maize in Middle America. Our Orinocan and Antillean material would seem to be derived from the former center and our western Venezuelan remains, from the latter; between the two, in central Venezuela, we find a zone of mixture. (These conclusions are discussed in detail in a monograph by Cruxent and myself entitled *An Archaeological Chronology of Venezuela*, which is soon to be published by the Pan-American Union.)

Steward thought that the Indians had descended from his Andean center with "Circum-Caribbean" culture, characterized by relatively elaborate ceremonial and political developments, and he assumed that, when the Indians reached the lowlands, they regressed to a "Tropical Forest" level of development, except in a few places such as the Greater Antilles where the environment was exceptionally favorable. Archaeology indicates, on the contrary, that the original ceramic and agricultural occupants of both eastern and western Venezuela were on the Tropical Forest level. Circum-Caribbean culture apparently did not develop until Period IV and then only in certain isolated areas where the environment was most favorable.

Assembled by IRVING ROUSE

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